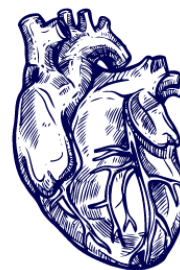


Host - Dr. Charlotte Durand  
Guest - Dr. Sophie Richards



### 1. Blood supply to the brain

#### **What are the main arteries contributing to the blood supply of the brain?**

- Posteriorly, the vertebral arteries merge to form the basilar artery
- Internal carotid arteries
- These anastomose via the anterior and posterior communicating arteries to form the Circle of Willis

#### **What are the main cerebral arteries and which lobes of the brain do they supply?**

- Some overlap in lobar supply
- Anterior cerebral artery - frontal, parietal lobes
- Middle cerebral artery - frontal, lateral temporal, parietal lobes
- Posterior cerebral artery - medial temporal, parietal, occipital lobes

#### **What motor and sensory areas lie in the distribution of the middle cerebral artery?**

- Motor and sensory areas of the contralateral side of the body except the legs and perineum
- Auditory and speech areas

#### **Which vessels make up the posterior circulation?**

- Posterior cerebral artery
- Superior cerebellar arteries
- Anterior and posterior inferior cerebellar arteries
- Pontine arteries

#### **What areas of the brain do the main arteries of the posterior circulation supply?**

- Vertebral arteries supply the cranial meninges and cerebellum
- Basilar arteries supply the brainstem, cerebellum and cerebrum
- Posterior cerebral arteries supply the inferior aspect of the cerebral hemispheres and occipital lobe
- Posterior communicating arteries supply the optic tract, cerebral peduncle, internal capsule and thalamus

#### **Describe the venous drainage of the cerebral hemispheres.**

- Superior cerebral veins drain the superolateral surface of the brain → superior sagittal sinus
- Inferior and superficial middle cerebral veins drain the inferior, posterior and deep aspects of the cerebral hemispheres → straight, transverse and superior petrosal sinuses
- Great cerebral vein → merges with inferior sagittal sinus to form the straight sinus
- Eventually these terminate in the internal jugular veins

## 2. Skull

### Identify the bones and sutures of the cranial vault

- Frontal bone
- Parietal bone
- Occipital bone
- Temporal bone
- Sphenoid bone
- Coronal suture
- Sagittal suture
- Lambdoid suture

### What are the major bony compartments within the base of the skull?

- Anterior cranial fossa - formed by the frontal bone, ethmoid bone and lesser wing of the sphenoid
- Middle cranial fossa - formed by the sphenoid and squamous temporal bones laterally. Contains the sella turcica
- Posterior cranial fossa - occipital bone, sphenoid.

### Identify the foraminae in the base of the skull

- From anterior to posterior
- Cribriform plate - olfactory nerve
- Optic canal - optic nerve and ophthalmic artery
- Superior orbital fissure - oculomotor, trochlear, ophthalmic division of the trigeminal and abducens
- Foramen lacerum - internal carotid artery
- Internal acoustic meatus - cranial nerve VII, VIII
- Foramen rotundum - V2 (Maxillary) "maximally rotund"
- Foramen ovale - V3 (mandibular) because ovale is like the shape of an open mouth - mandible
- Foramen spinosum - middle meningeal artery
- Foramen magnum - medulla/brainstem plus the vertebral arteries, CNXI,
- Jugular foramen - CN IX, X, XI and the internal jugular vein
- Hypoglossal canal - CN XII

## 3. Cranial Nerves

### What is the nerve supply to the extraocular muscles?

Cranial nerve III - oculomotor

- superior, inferior, medial rectus muscles, inferior oblique,
- Levator palpebrae superioris
- Parasympathetic supply through ciliary ganglion to smooth muscle of the sphincter pupillae and ciliary muscle

Cranial nerve IV - Trochlear

- Superior oblique

Cranial nerve VI - Abducens

- Lateral rectus

**What is the effect of a complete third nerve lesion?**

- Resting position becomes a depressed/abducted eye
- Ptosis
- Dilated pupil

**What is the effect of a 4th nerve lesion?**

- Loss of superior oblique
- Inability to look down while looking in
- Extorsion - compensate by tilting to the opposite shoulder

**What are the branches of the trigeminal nerve?**

Arises from the pons (*an easy way to remember is the first 4 CN's arise above the pons (CN I - IV), the next 4 arise from the pons itself (CNV-VIII) and then the last 4 arise below the pons (CN IX-XII)*)

- Ophthalmic (V1) sensory - smallest, goes via supraorbital fissure
- Maxillary (V2) sensory
- Mandibular (V3) sensory & motor

**Describe the motor and sensory distribution of the trigeminal nerve**Motor

- Muscles of mastication (masseter, temporalis, medial pterygoid, lateral pterygoid)
- Mylohyoid
- Anterior belly of digastric
- Tensor tympani
- Tensor veli palatini

Sensory

- Skin of face and anterior scalp
- eyelids/cornea/conjunctiva
- nose/mucosa of nasal cavity
- Paranasal sinuses
- Ear
- mouth/lip/gingiva/palate
- Tongue (general sensation anterior 2/3rds - facial does taste)
- Dura of anterior and middle cranial fossa

**4. Intracranial structures**

**You will be shown an image of a head CT and be asked to describe some normal structures**

- Lobes: frontal, temporal, parietal occipital
- Lateral ventricles: anterior and posterior horns, 3rd ventricle
- Caudate nucleus, putamen
- Thalamus, internal capsule

- Septum pellucidum
- Falx

#### **Describe the circulation of CSF**

- Formed in the choroidal epithelial cells in lateral, 3rd and 4th ventricles
- Flows from the lateral ventricles to the 3rd ventricle via the interventricular foramina
- 3rd ventricle → 4th ventricle via the aqueduct
- Some CSF passes into the subarachnoid space via the median and lateral apertures
- Most CSF passes into interpeduncular and quadrigeminal cisterns
- CSF from the various subarachnoid cisterns flows superiorly through the sulci and fissures on medial and superolateral surfaces of the cerebral hemispheres
- Absorbed into the arachnoid granulations, especially those that protrude into the superior sagittal sinus

#### **What are the functions of CSF?**

- Protects the brain by providing a cushion effect
- The buoyancy effect prevents compression of nerves and vessels

#### **Describe the ventricular system of the brain**

- Lateral ventricles with anterior and posterior horns are the largest. Each opens into the 3rd ventricle via the interventricular foramen
- 3rd ventricle = slit like opening between two diencephalon halves
- Continues as cerebral aqueduct which connects the 3rd and 4th ventricles
- 4th ventricle = pyramid shaped, posterior part of the pons and medulla.

## **5. The eyes**

#### **Identify the extraocular eye muscles on this model**

- Superior rectus
- Inferior rectus
- Medial rectus
- Lateral rectus
- Superior oblique
- Inferior oblique

#### **Describe their actions**

##### **Recti**

- Superior (elevation, adduction, medial rotation)
- Inferior (depression, adduction, lateral rotation)
- Medial (adduction)
- Lateral (abduction)

##### **Obliques**

- Superior (depression, abduction)
- Inferior (elevation, abduction)

**What nerve supplies these muscles?**

- Oculomotor nerve
- Abducens nerve to the lateral rectus
- Trochlear nerve to the superior oblique

**How are the actions of these muscles tested clinically?**

Abduction (lateral rectus)

When in abduction

- Elevation - superior rectus
- Depression - inferior rectus

When in adduction

- Elevation - inferior oblique
- Depression - superior oblique

**6. Orbits**

**Which bones form the walls of the orbit?**

- Roof - orbital part of the frontal bone and posteriorly the lesser wing of the sphenoid
- Medial - ethmoid with contributions from the frontal process and the maxilla, lacrimal and sphenoids
- Lateral - frontal process of zygomatic bone and the greater wing of sphenoid
- Floor - maxilla and partly by the zygomatic and palatine bone

**What structures pass through the superior orbital fissure?**

- Ophthalmic nerve (V1)
- Oculomotor nerve (CNIII)
- Trochlear (CNIV)
- Abducens nerve (VI)
- Sympathetic fibres and ophthalmic veins

**What is the course of the infra-orbital nerve?**

- Continuation of the maxillary nerve (V2)
- Enters the orbit through the infraorbital fissures and travels in the infraorbital groove
- Exits through the infraorbital foramen
- Distribution to the cheek, lower lid, lateral nose, upper lip and gums and antero/inf nasal septum

**What structures does the intra-orbital nerve innervate?**

- Mucosa of maxillary sinuses
- Upper medial teeth
- Skin of the cheek

- Skin of lateral nose
- Skin/conjunctiva of inferior eyelid
- Anterior Inferior nasal septum
- Skin and oral mucosa of the upper lip

**What are the muscles of facial expression?**

- Orbicularis oculi
- Orbicularis oris
- Zygomaticus muscles
- Buccinators

**7. The eyeball**

Identify the structures of the eyeball

- Cornea
- Anterior chamber/lens/iris/ciliary body/limbus
- Vitreous body
- Choroid
- Sclera
- Retina
- Optic nerve and disc

**Describe the formation and drainage of aqueous humour**

- Production by ciliary processes
- Enters the posterior chamber
- Passes through the pupil to the anterior chamber
- Filters through the iridocorneal angle to the canal of schlemm
- Drains into the anterior scleral veins

**8. The face****What is the arterial supply to the face?**

- Facial artery- arises from the external carotid artery, contacts the submandibular gland, hooks up over the mandible anterior to the masseter then takes a tortuous course to the medial angle of the eye
- The transverse facial artery anastomoses with the above

**What is the course and the branches of the facial nerve?**

- Emerges through the temporal bone via the stylomastoid foramen
- Then divides into superior and inferior divisions
- Supplies the posterior auricular nerve
- Before entering the posterior medial surface of the parotid gland
- Within the parotid forms 5 branches

5 branches

- Temporal
- Zygomatic

- Buccal
- Marginal Mandibular
- Cervical

**What is the function of the facial nerve?**

- Motor supply of the face
- Muscles of facial expression
- Taste to the anterior 2/3rd of the tongue
- Skin at the external acoustic meatus
- Sublingual and submandibular glands
- Lacrimal glands

**What is the sensory nerve supply of the face?**

Trigeminal (5th cranial nerve) has 3 branches - ophthalmic, maxillary, mandibular

**9. Mandible**

**What are the features of this bone?**

Body, angle, ramus, condyle (includes the head and neck), coronoid process, pterygoid fossa, mandibular notch, lingula, mylohyoid groove, submandibular fossa, sublingual fossa, symphysis, mental protuberance, alveolar processes, mental tubercles, digastric fossa

**Describe the features of the temporomandibular joint**

- Bones - condyle of the mandible, articular tubercle and the mandibular fossa
- Disc - separates superior synovial cavity (gliding in/out) and inferior synovial cavity (hinge up/down)
- Postglenoid tubercle and temporomandibular (lateral) ligament prevent posterior dislocation
- Stylomandibular and sphenomandibular ligaments are weak

**What movements is the mandible capable of at the TMJ?**

- Protrusion/retrusion
- Depression/elevation
- Lateral movement

**What factors contribute to the stability of the TMJ?**

- Shape of the TMJ
- Occlusion and teeth
- Stylomandibular ligament
- Sphenomandibular ligament
- Capsule of joint
- Muscles of mastication

**Which nerve passes through this bone?**

- Inferior alveolar nerve
- Enters the mandibular foramen
- Within the mandible supplies mandibular teeth
- Exits the mental foramen as the mental nerve (supplies skin and mucous membranes of the lower lip and skin of chin)
- The close relationship of this nerve to the bone makes it vulnerable to injury

**What nerve does the inferior alveolar nerve arise from?**

Mandibular nerve (V3- 3rd branch of the trigeminal nerve)

**Describe the mandibular attachments of the muscles of mastication**

- Temporalis - from the temporal fossa to the medial coronoid and anterior ramus
- Masseter - maxillary process and zygomatic arch to angle and lateral ramus
- Lateral pterygoid - greater wing sphenoid and lateral surface of the lateral pterygoid plate to joint capsule, disc and pterygoid fossa on the neck of mandible
- Medial pterygoid - from the medial surface of the lateral pterygoid plate and the tuberosity of the maxilla to medial ramus below the foramen

**10. The tongue****What structures make up the floor of the mouth**

Mandible, tongue, lip, teeth, geniohyoid muscle, hyoid bone, stylohyoid muscle, genioglossus muscle

**Describe the innervation of the tongue**

- Motor - all muscles except the palatoglossus are supplied by cranial nerve XII, the hypoglossal nerve. The palatoglossus is a palatine muscle so is supplied by the pharyngeal plexus.
- General sensation to the mucosa of the anterior  $\frac{2}{3}$  of the tongue is supplied by the lingual nerve, a branch of the CNV3
- Taste to the anterior  $\frac{2}{3}$  via the chorda tympani (from the facial nerve)
- Posterior  $\frac{1}{3}$  of the tongue, both general sensory and taste supplied by the lingual branch of the glossopharyngeal nerve
- Parasympathetic fibres via the chorda tympani supply the submandibular and salivary glands

**11. The ear**

- What is the sensory supply to the pinna
- Greater auricular nerve (C2) cranial surface and lower half
- Auriculotemporal (from CNV3) supplies the upper half and most of the meatus

**What other nerves supply the ear and the canal**

- Lesser occipital



- Vagus
- Glossopharyngeal
- Facial nerve

**12. C1/C2 - Note: we are not going to go through naming the parts of the bones but you will need to know that for the exam- can be shown a labelled photo of C1 and C2**

**What are the characteristics of a typical cervical vertebra?**

- Small oval body with a large vertebral canal
- Concave on superior surface and convex on the inferior surface
- Spinous processes are short bifid and downward sloping (C7 usually not bifid)
- Facet joints are more horizontal to allow for greater movement
- Anterior and posterior transverse processes with a foramen transversum allowing passage of the vertebral artery, vein and sympathetic plexus

**Describe the joints between C1 and C2**

- Two lateral atlanto axial joints - synovial joints, exist between the inferior articular facet of the atlas and the superior articular facet of the axis on each side.
- Median atlanto-axial joint - synovial joint between the arch of C1 and the dens, it is a pivot joint

**What movements occur at the atlanto-axial joint?**

Gliding at the lateral joints and pivoting at the median joint which permits rotation of the head via rotation of C1 on C2

**Which ligaments stabilise the joints between C1 and C12?**

- Cruciate or cruciform ligament - made up of strong transverse ligament across the atlas behind the dens and weaker vertical bands from the back of the body of the axis, running posterior to the dens and attaching on the base of the occiput. This holds the dens in position and prevents pressure from the dens onto the medulla.
- 2 Alar Ligaments - run from the sides of the dens to the edge of the foramen magnum. They are strong and limit rotation
- Tectorial membrane - a continuation of the posterior longitudinal ligament, attached from the back of the body of the axis to anterior half of the foramen magnum.

### 13. Vasculature

#### What are the boundaries of the anterior triangle of the neck?

Anterior border of the sternocleidomastoid, lower border of the mandible and the midline

#### Discuss the anatomy of the right common carotid artery

- Begins at the bifurcation of the brachiocephalic trunk behind the sternoclavicular joint and into the common carotid and subclavian arteries
- In the neck it lies within the medial part of the carotid sheath, with the internal jugular vein lateral to it and the vagus nerve deep between the two vessels.
- The common carotid bifurcates at the level of the upper border of the lamina of the thyroid cartilage into the internal and external carotid arteries.

#### Describe the surface marking of the internal jugular vein

From the mastoid to the medial end of the clavicle

#### What major structures are at risk during insertion of an IJ line?

- External carotid artery
- Common carotid artery
- Vagus nerve (and other nerves)
- Lung
- Trachea
- Thyroid
- SCM

### 14. Larynx - Note: Need to be able to identify key structures on the model - do this

#### What is the nerve supply to the muscles of the larynx?

Recurrent laryngeal nerve (from the vagus) supplies all muscles except the cricothyroid muscle which is supplied by the external laryngeal nerve

#### And the sensory innervation?

- Above the cords - internal laryngeal nerve which is a branch of the superior laryngeal nerve
- Below the cords - recurrent laryngeal nerve, which is a branch of the inferior laryngeal nerve

#### Demonstrate the landmarks for a surgical airway - cricothyrotomy

Thyroid cartilage, cricoid cartilage, cricothyroid membrane

#### Which cartilage of the larynx is fully circumferential?

Cricoid

**What are the paired cartilages of the larynx?**

Arytenoids, corniculates and cuneiforms

**What are the muscles of vocalisation?**

- Cricothyroid
- Thyroarytenoid
- Posterior cricoarytenoid
- Lateral cricoarytenoid
- Transverse and oblique arytenoids
- Vocalis