High Yield MCQs Neurosurgery Part I

Topics

- Anatomy and physiology
- General and neurology
- Imaging and diagnostics
- Coma and Brain Death
- Developmental anomalies
- Infection
- Hydrocephalus and CSF
- Neuro-ophthalmology and Neurotology

- Primary tumors of the nervous and related systems
- Tumors involving non neural origin : metastases, lymphomas, chordomas
- Head Trauma
- SAH and aneurysms
- Vascular malformations
- Stroke, ICH
- Differential diagnosis
- Important points in Neurosurgery

Q. About cortical surface anatomy true is :

A. The central sulcus joins the sylvian fissure in only 2% of the cases

B. Superior temporal sulcus terminates in the angular gyrus

C. Sylvian fissure terminates in the supramarginal gyrus

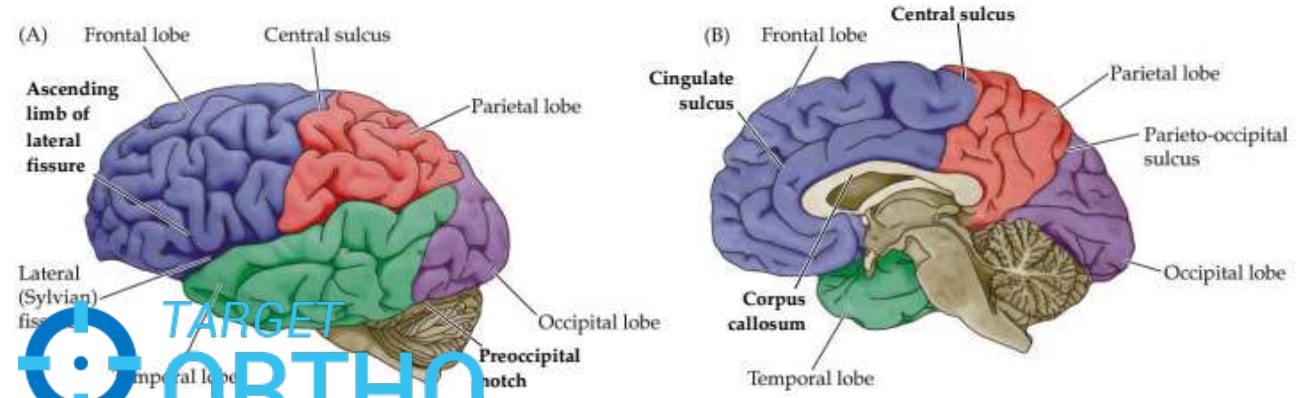
D. Inferior temporal gyrus contain the pars opercularis, pars triangularis and pars orbitalis

E. In 98% of cases there is sub central gyrus

Ans. A to C and E

- Inferior frontal gyrus contain the pars opercularis, pars triangularis, pars orbitalis

- The pre-central sulcus is not Complete. The middle frontal gyrus connects with the pre-central gyrus via a thin isthmus.
- The central sulcus is separated from the sylvian fissure 98% of the time. The tissue separating them is called the subcentral gyrus.
- The central sulcus joins the sylvian fissure in only 2%.
- The inferior and superior parietal lobules are separated by the intra-parietal sulcus
- The inferior parietal lobule is composed of the supramarginal gyrus (SMG) and the angular gyrus
- The sylvian fissure terminates in the SMG which is the Brodmann area 40
- The superior temporal gyrus terminates in the AG which is the Brodmann area 39



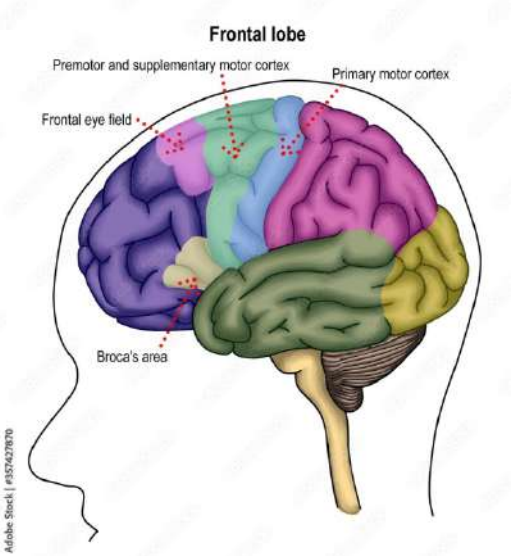
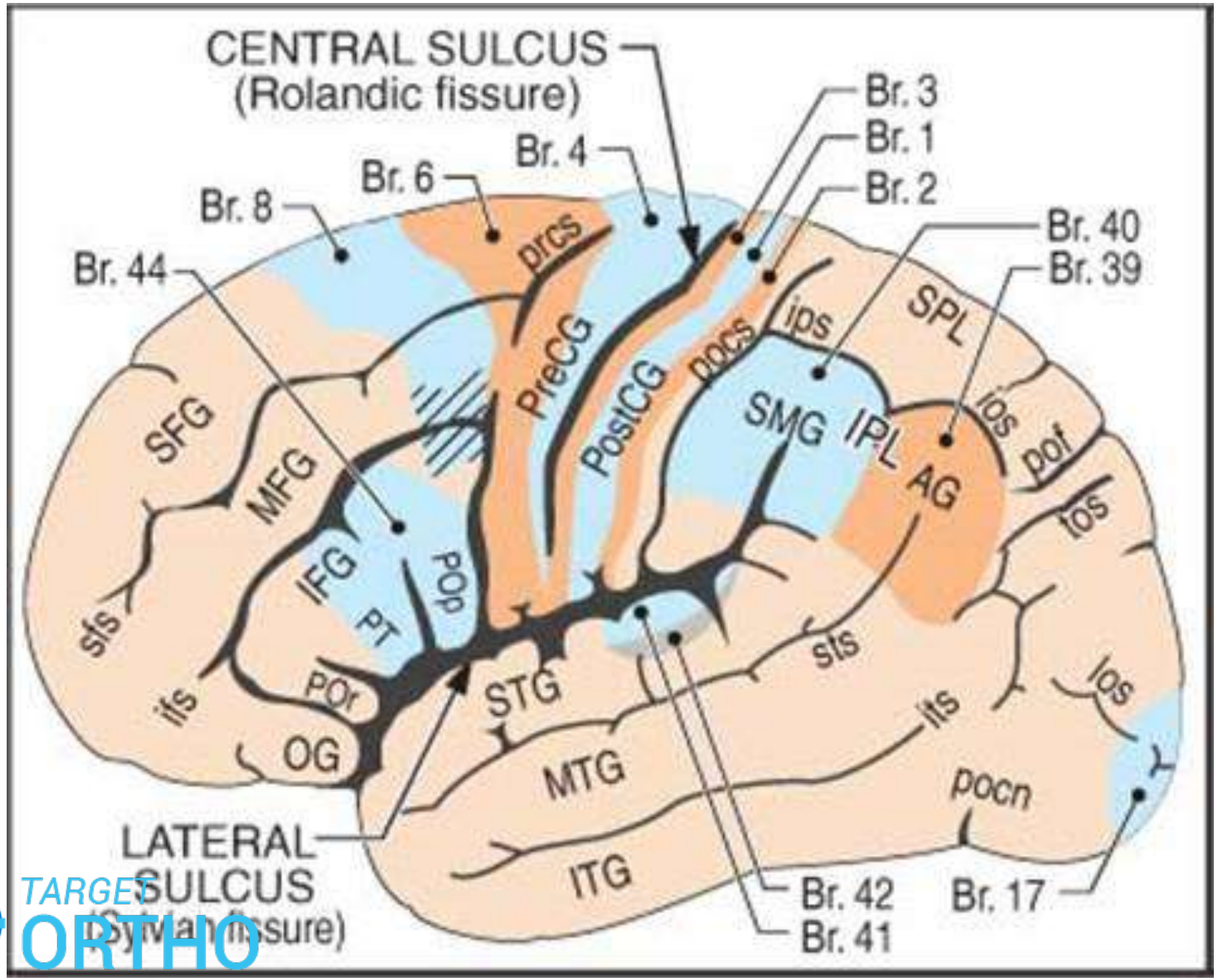


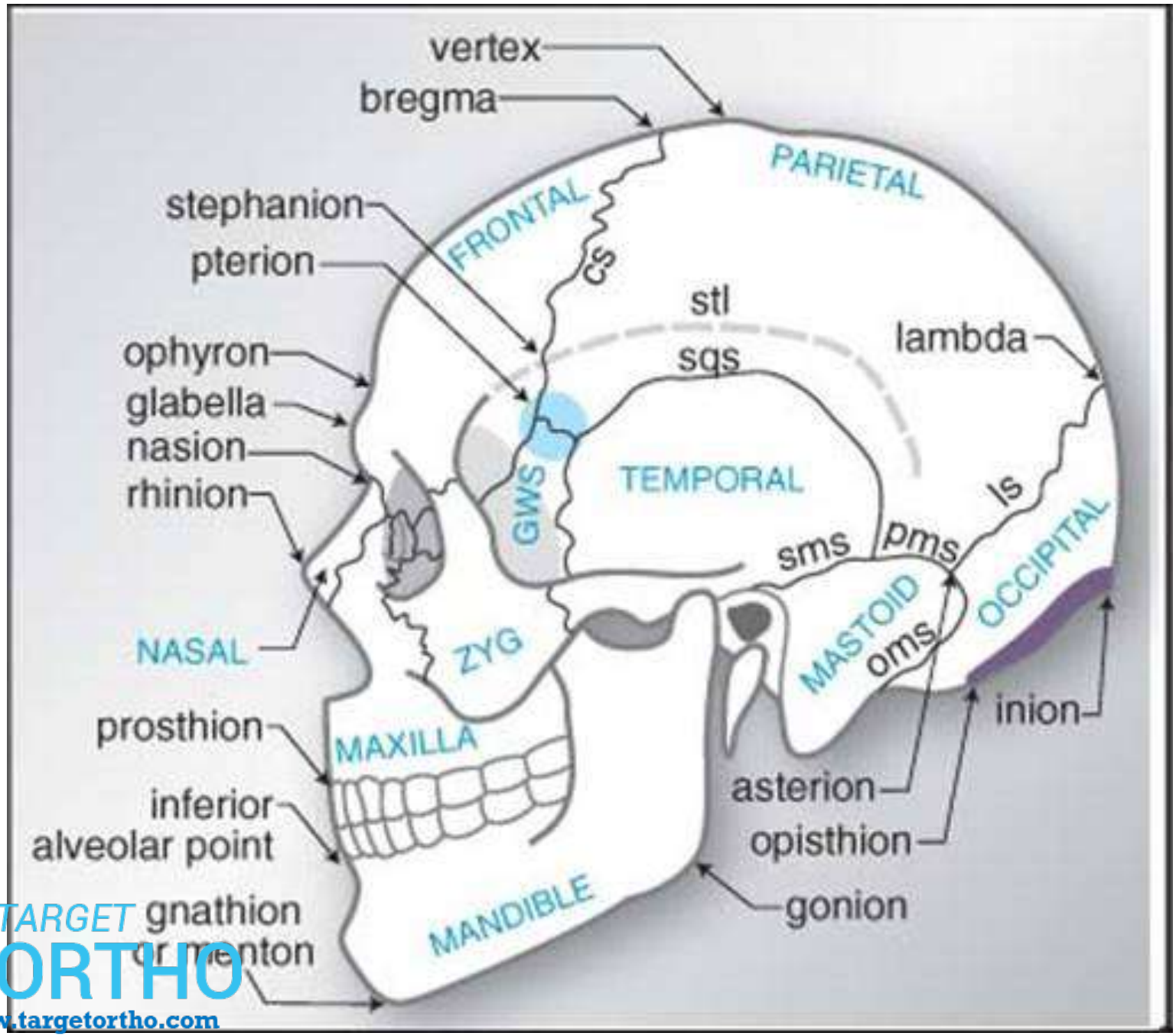
Figure 1.5. Lateral and midsagittal views of the human brain, emphasizing the division of the cerebral cortex into four lobes (identified with color). (Figure A4 from Neuroscience, 6th Ed.)



- Br. areas 3,1,2: primary somatosensory cortex
- Br. areas 41 & 42: primary auditory areas (transverse gyri of Heschl)
- Br. area 4: precentral gyrus, primary motor cortex (AKA "**motor strip**"). Large concentration of giant pyramidal cells of Betz
- Br. area 6: premotor area or supplemental motor area. Immediately anterior to motor strip, it plays a role in contralateral motor programming
- Br. area 44: (dominant hemisphere) **Broca's area** (motor speech)
- Br. area 17: primary visual cortex
- **Wernicke's area** (language): in the dominant hemisphere, most of Br. area 40 and a portion of Br. area 39 (may also include ≈ posterior third of STG)
- the striped portion of Br. area 8 (frontal eye field) initiates voluntary eye movements to the opposite direction

CRANIOMETRIC POINTS

- **Pterion**: region where the following bones are approximated: frontal, parietal, temporal and sphenoid (greater wing). Estimated as 2 fingerbreadths above the zygomatic arch, and a thumb's breadth behind the frontal process of the zygomatic bone.
- **Asterion**: junction of lambdoid, occipitomastoid and parietomastoid sutures. Usually lies within a few millimeters of the posterior-inferior edge of the junction of the transverse and sigmoid sinuses (not always reliable - may overlie either sinus).
- **Lambda**: junction of the lambdoid and sagittal sutures.
- **Stephanion**: junction of coronal suture and superior temporal line.
- **Glabella**: the most forward projecting point of the forehead at the level of the supraorbital ridge in the midline.
- **Opisthion**: the posterior margin of the foramen magnum in the midline.



- **Bregma**: the junction of the coronal and sagittal sutures.
- **Sagittal suture**: midline suture from coronal suture to lambdoid suture. Although often assumed to overlie the superior sagittal sinus **(SSS)**, the SSS lies to the right of the sagittal suture in the majority of patients (but never by > 11 mm).

Somatotopic organization of primary sensory and motor cortex

- The primary motor cortex (AKA “motor strip”) and primary (somato)sensory cortex are organized somatotopically so that specific regions of the brain map correspond to specific areas of the body .
- The regions are often drawn with a caricature of a human figure (the homunculus—Latin for “little man”).
- Some key points: the representation of the arm and face are draped over the convexity of the brain, while the foot and leg areas are located along the upper aspect of the medial surface. Areas with fine motor or sensory function (e.g. fingers, tongue) have a larger area of representation.

Cranial Foramina and their contents

FORAMEN	CONTENTS
superior orbital fissure	Cr. Nn. III, IV, VI, all 3 branches of V1 (ophthalmic division divides into nasociliary, frontal, and lacrimal nerves); superior ophthalmic vv.; recurrent meningeal br. from lacrimal a.; orbital branch of middle meningeal a.; sympathetic filaments from ICA plexus
inferior orbital fissure	Cr. N. V-2 (maxillary div.), zygomatic n.; filaments from pterygopalatine branch of maxillary n.; infraorbital a. & v.; v. between inferior ophthalmic v. & pterygoid venous plexus

foramen lacerum	usually nothing (ICA traverses the upper portion but doesn't enter, 30% have vidian a.)
carotid canal	internal carotid a., ascending sympathetic nerves
foramen magnum	spinal cord (medulla oblongata); Cr. N. XI (spinal accessory nn.) entering the skull; vertebral aa.; anterior & posterior spinal arteries
cribriform plate optic canal foramen rotundum foramen ovale foramen spinosum jugular foramen stylomastoid foramen	Olfactory nn. Cr. N. II (optic); ophthalmic a Cr. N. V2 (maxillary div.), a. of foramen rotundum Cr. N. V3 (mandibular div.) middle meningeal a. & v. Internal jugular v. (beginning); Cr. Nn. IX, X, XI Cr. N. VII (facial); stylomastoid a.

Q. About cerebral arterial anatomy true is :

A. A balanced configuration of the Circle of Willis is present in only 18% of the population

B. 15-35% of patients supply their posterior cerebral artery on one or both sides from the carotid (via P-comm) instead of via the vertebrobasilar system (Foetal circulation)

C. Hypoplasia of one or both P-communicating arteries occurs in 22-32%, absent or hypoplastic A1 segment occurs in 25%

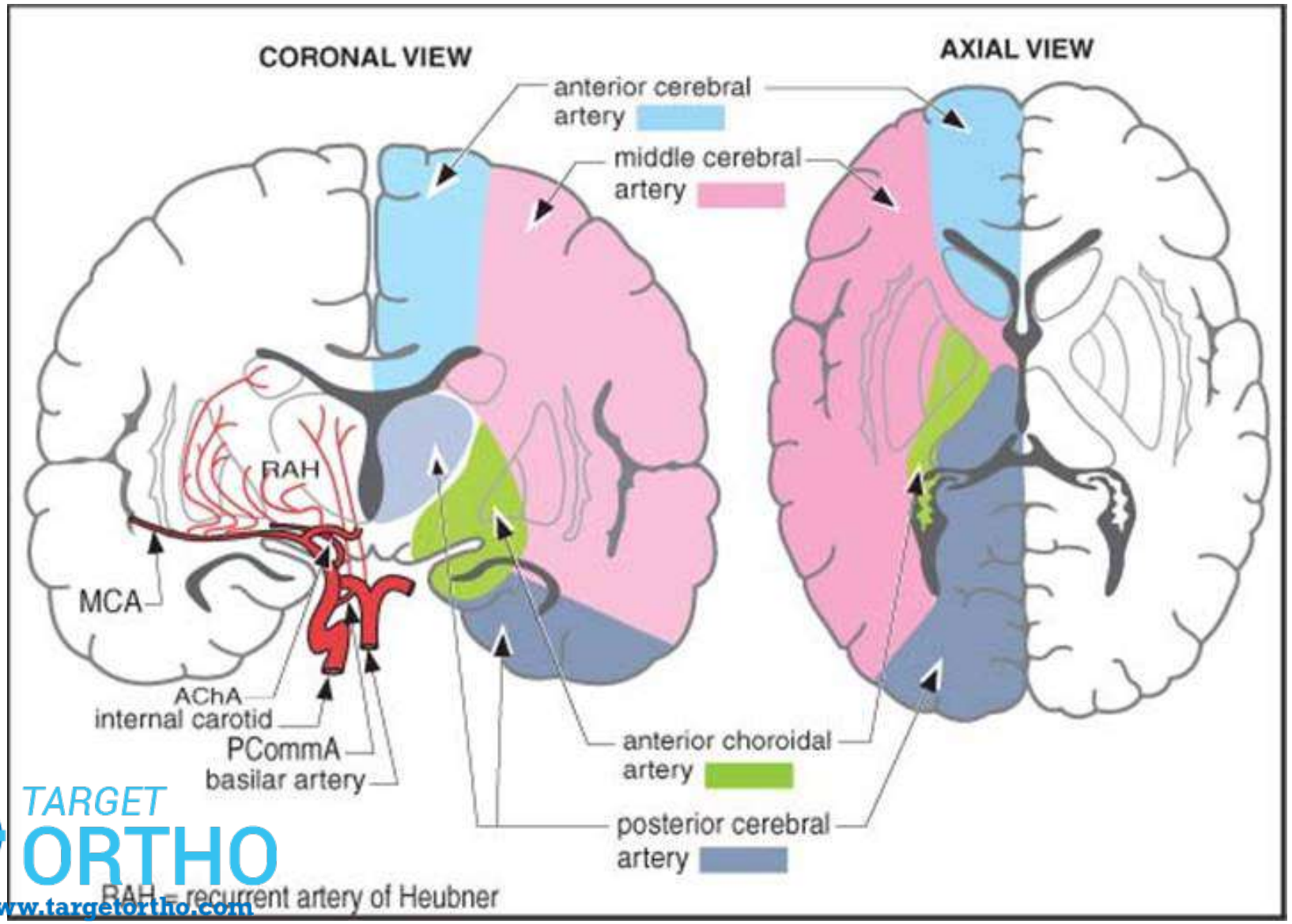
D. [P-3] segment of the posterior cerebral artery transverses the ambient cistern

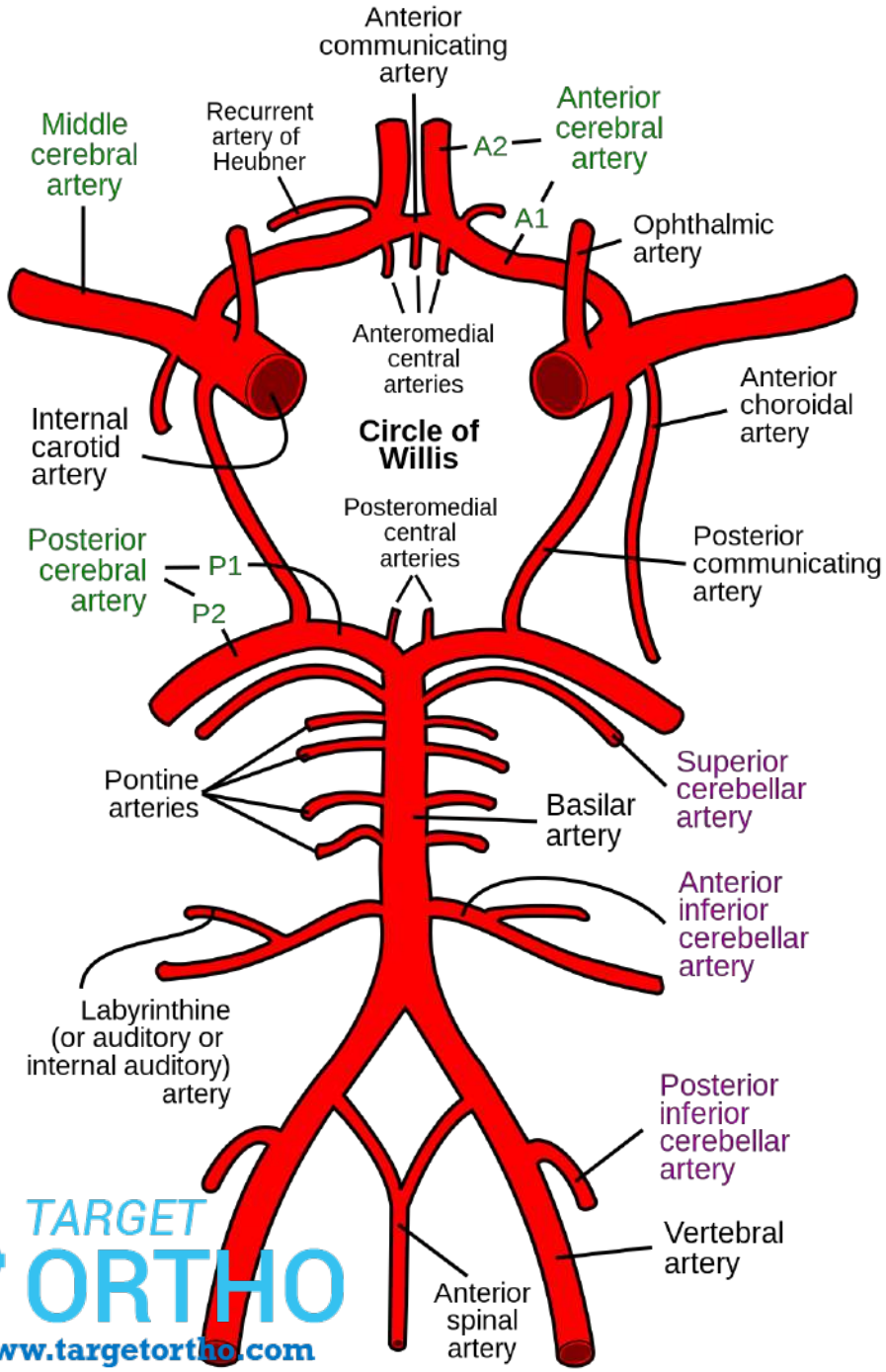
E. Recurrent artery of Heubner arises commonly from A2 segment of anterior cerebral artery

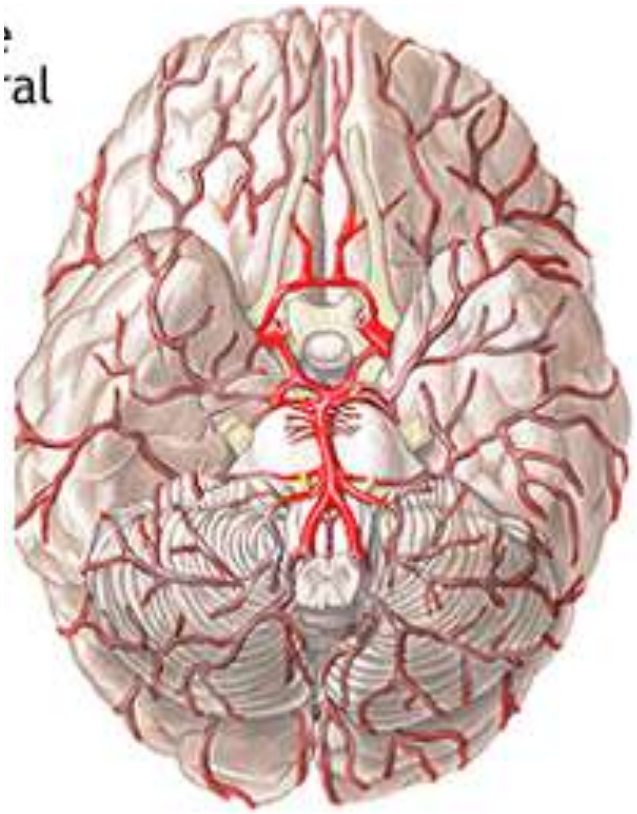
Ans. A to C and E

P-2 segment of the posterior cerebral artery transverses the ambient cistern.
P-3 transverses the quadrigeminal cistern and give rise to terminal branches

CEREBROVASCULAR ANATOMY

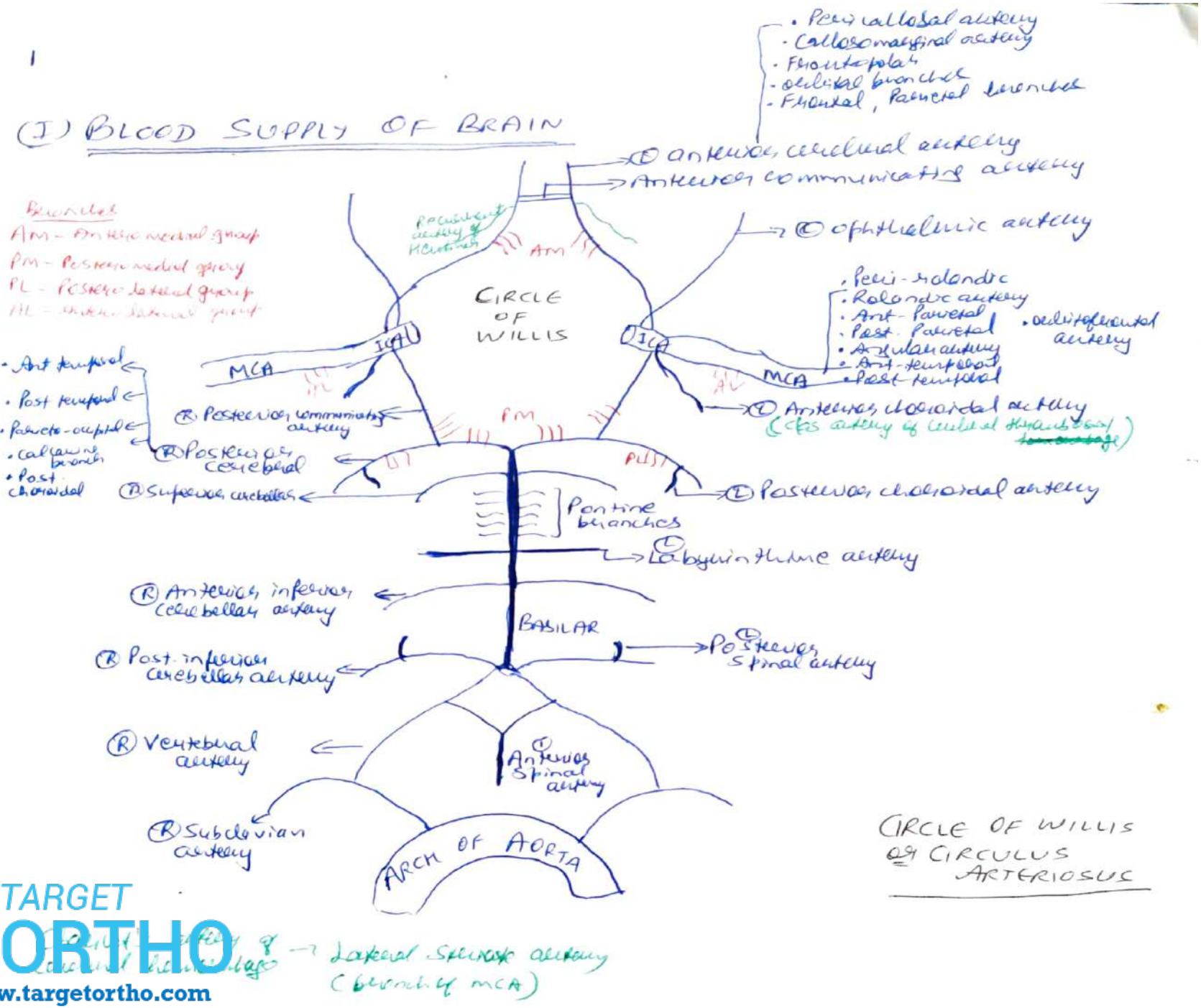






Bottom view of brain

(I) BLOOD SUPPLY OF BRAIN



CIRCLE OF WILLIS
OR CIRCULUS ARTERIOSUS

- The circle of Willis encircles the stalk of the pituitary gland and provides important communications between the blood supply of the forebrain and hindbrain i:e between the internal carotid and vertebro-basilar system.
- At the Circle of Willis, the internal carotid arteries branch into smaller arteries that supply oxygenated blood to over 80% of the cerebrum.
- A balanced configuration of the Circle of Willis is present in only 18% of the population.
- Hypoplasia of 1 or both p-comms occurs in 22-32%, absent or hypoplastic A1 segments occurs in 25%.

➢ **Anatomical segments of intracranial cerebral arteries** :

❑ **Anterior Cerebral artery** :

- A1 (precommunicating): ACA from origin to ACoA
- A2 (postcommunicating): ACA from ACoA to branch-point of callosomarginal
- A3 (precallosal)
- A4 (supracallosal)
- A5 terminal branch (postcallosal)

Recurrent artery of heubner *typically arises from the area of the A1/A2 junction. one of the larger medial lenticulostriates, remainder of lenticulostriates may arise from this artery ⇒ head of caudate, putamen, and anterior internal capsule.*

❑ **Middle cerebral artery** :

- M1: MCA from origin to bifurcation
- M2: MCA trunks from bifurcation to emergence from Sylvian fissure
- M3–4: distal branches
- M5: terminal branch

❑ **Posterior cerebral artery** :

- P1: PCA from the origin to posterior communicating artery
- P2: PCA from origin of p-comm to the origin of inferior temporal arteries (AKA ambient, postcommunicating segment). P2 traverses the **ambient cistern**.
- P3: PCA from the origin of the inferior temporal branches to the origin of the terminal branches. P3 traverses the **quadrigeminal cistern**
- P4

Anatomic Variants :

- Bovine circulation : when the common carotid arise from a common trunk off the aorta
- Hypoid : having only one anterior cerebral artery

- **Internal carotid artery (ICA)** :

Segments of the ICA and its branches :

- C1 (cervical): No branches
- C2 (petrous)
- C3 (Lacerum) : caroticotympanic branch, pterygoid (vidian- present in only 30% cases)
- C4 (Cavernous) :

a) meningohypophyseal trunk (MHT) (largest & most proximal). 2 causes of a prominent MHT:

(1) tumor (usually petroclival meningioma), (2) dural AVM

Branches of MHT:

- artery of tentorium (AKA artery of Bernasconi & Cassinari): the blood supply of petroclival meningiomas
- dorsal meningeal artery
- inferior hypophyseal artery (supplies posterior lobe of piyuitary)

b) anterior meningeal artery

c) capsular artery of McConnell (in 30%): supply the capsule of the pituitary

- C5 (Clinoid)
- C6 (Ophthalmic) :

  a) ophthalmic artery : the ophthalmic artery is absent in 3% . Its intracranial course is very short, usually 1–2mm). Has a characteristic bayonet-like “kink” on lateral angiogram.

  b) superior hypophyseal artery (supplies anterior lobe of pituitary & stalk)
- C7 (Communicating) :

  a) posterior communicating a. (p-comm)

  few anterior thalamoperforators (⇒ optic tract, chiasm & posterior hypothalamus)

  b) anterior choroidal artery : supplies portion of optic tract, medial globus pallidus, genu of internal capsule (IC) (in 50%), inferior half of posterior limb of IC, uncus, retrolenticular fibers (optic radiation), lateral geniculate body. It is also referred to as artery of cerebral thrombosis.

Q. True about petroclival meningioma is :

A. Arterial feeders is from Internal carotid artery

B. Embolization by small particles cause more complications

C. Liquid embolization is preferred than small particles

D. Onyx is most commonly used for its embolization

Ans : A

Q. Blood flow ratio Internal carotid artery: External carotid artery

A. 60:40

B. 70:30

C. 80:20

D. 90:10

Ans: C

- Most studies describe the blood flow velocities in ICA or CCA as a determinant of stenosis. In one study, it was found that the blood flow ration between ICA/ECA as 0.8, meaning the flow between ICA:ECA would be 80:20.

➢ **Vertebral artery** : V1, V2, V3, V4

- The VA is the first and usually the largest branch of the subclavian artery. Variant: the left VA arises off the aortic arch in ≈ 4%. Diameter ≈ 3mm. Mean blood flow ≈ 150 ml/min. The left VA is dominant in 60%.
- The right VA will be hypoplastic in 10%, and the left will be hypoplastic in 5%. The VA is atretic and does not communicate with the Basilar artery on the left in 3%, and on the right in 2%.

  Fetal circulation - 15–35% of patients supply their posterior cerebral artery on one or both sides primarily from the carotid (via p-comm) instead of via the vertebrobasilar system .
- Branches of VA : Posterior spinal artery, Posterior inferior cerebellar artery (PICA) (largest branch), anterior spinal artery.

➢ **Basilar Artery** : Formed by the junction of the 2 vertebral arteries

- Branches - anterior inferior cerebellar artery (AICA), internal auditory (labyrinthine), superior cerebellar artery, *posterior cerebral artery (has P1-P4 segments).*

- Applied aspect :

❑ Occlusion of anterior cerebral artery : C/L hemiparesis and hemianaesthesia involving mainly the leg and foot, due to involvement of upper part of primary motor and sensory areas. Inability to identify objects correctly due to involvement of superior parietal lobule. Apathy and personality changes due to frontal lobe involvement.

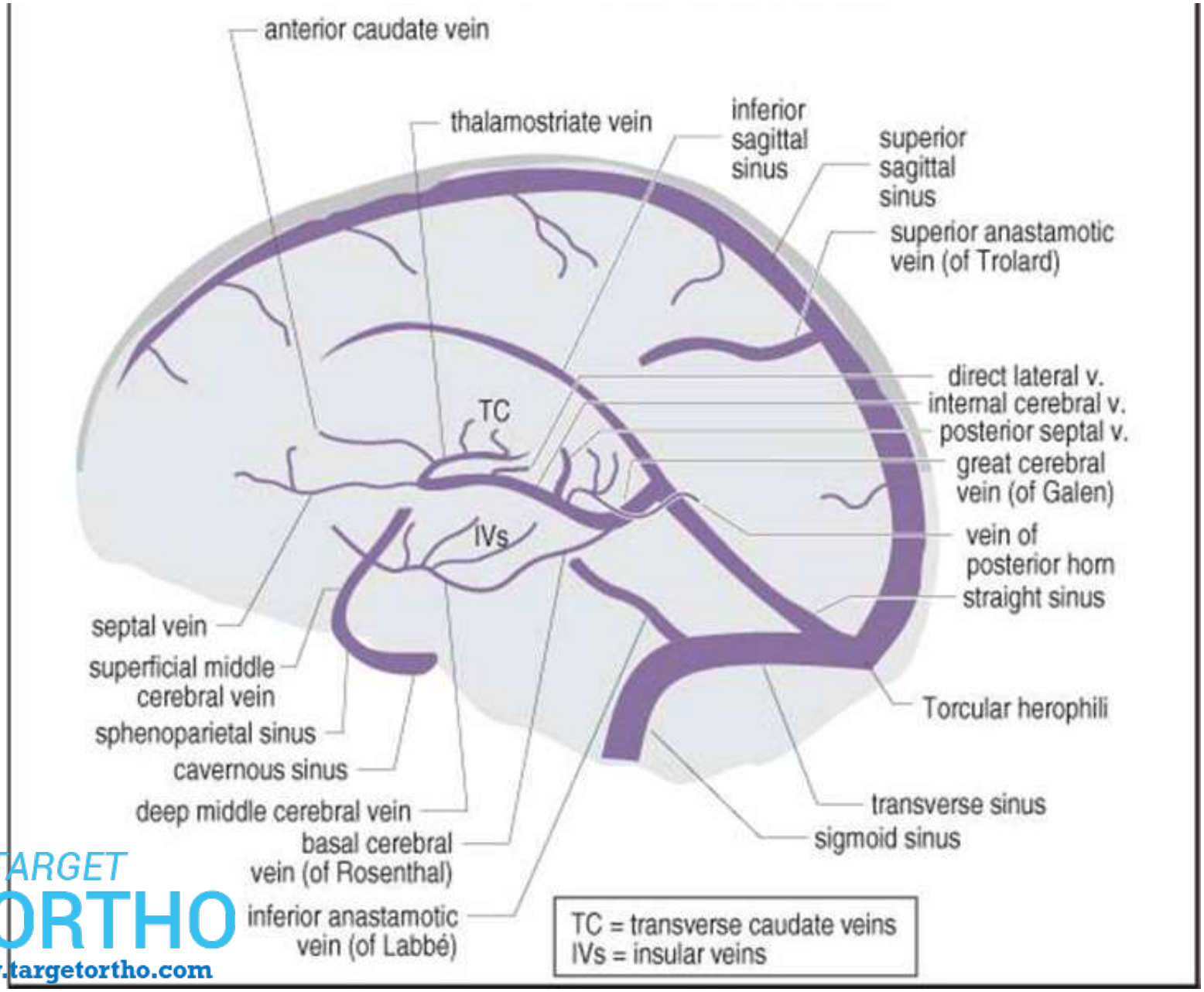
❑ Occlusion of middle cerebral artery : C/L Hemiplegia and hemianaesthesia involving mainly the face and arm. Aphasia if dominant hemisphere is involved and C/L homonymous hemianopia (visual field defect) due to involvement of optic radiation.

❑ Occlusion of posterior cerebral artery : C/L homonymous hemianopia due to involvement of visual cortex with some degree of macular sparing. The macular vision is spared because it is represented in the occipital pole which receives a collateral supply from the MCA.

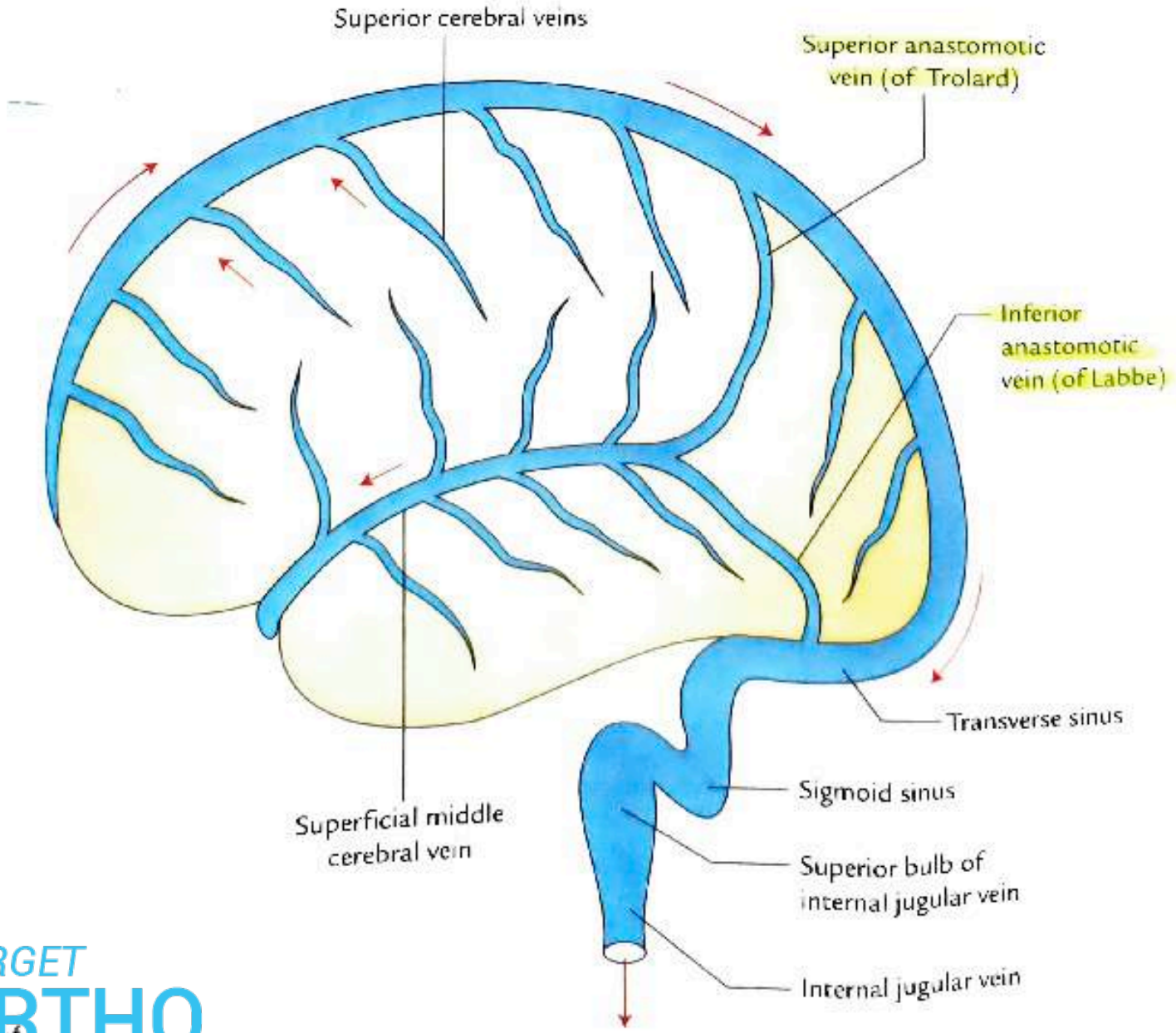
Cerebral Venous anatomy

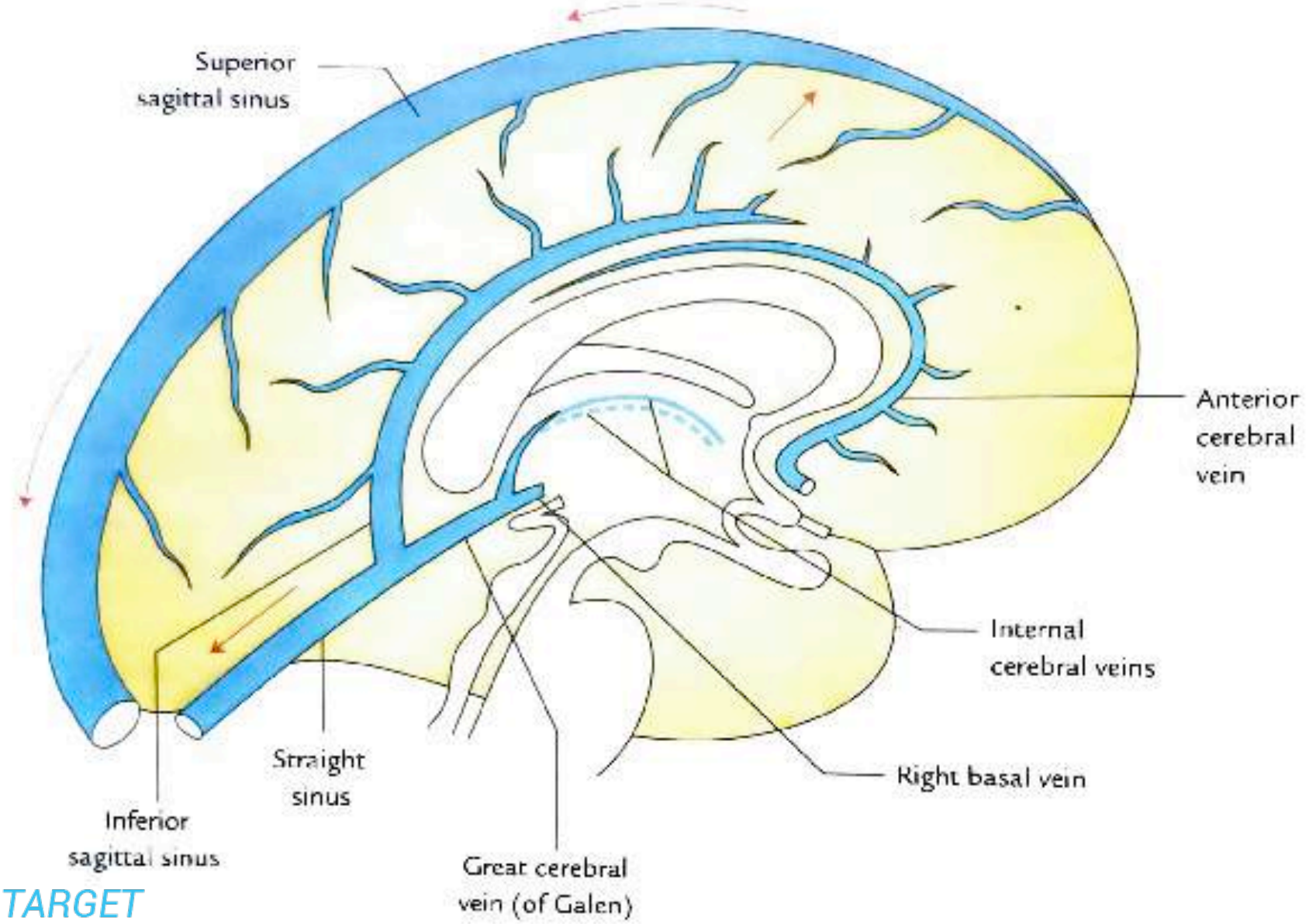
- The left and right internal jugular veins (IJVs) are the major source of outflow of blood from the intracranial compartment. Other sources of outflow include orbital veins and the venous plexuses around the vertebral arteries. Diploic and scalp veins may act as collateral pathways, e.g. with superior sagittal sinus obstruction.
- Veins emerge from brain –> traverse the subarachnoid space -> pierce the arachnoid mater and meningeal layer of duramater -> drain into the venous sinuses -> IJV
- The right internal jugular vein is usually dominant.
- The right transverse sinus is usually dominant.
- Characteristic features of venous drainage of brain are :

  - the venous return does not follow the arterial pattern
  - veins are extremely thin walled due to absence of muscular tissue
  - no valves
  - they enter obliquely into the dural venous sinuses to avois their possible collapse



- The veins of the brain are divided into external (superficial) cerebral veins and internal (deep) cerebral veins, depending on whether they drain the superficial structures of the brain or the deep structures.
- **Superficial veins of the cerebrum** : Superior cerebral veins, Inferior cerebral veins, Superficial middle cerebral vein
- **Deep veins of the cerebrum** : Internal cerebral veins, Great cerebral vein (of Galen), Basal veins
- **Veins of the cerebellum** : Superior cerebellar veins, Inferior cerebellar veins
- **Dural venous sinuses** : Superior sagittal sinus, Inferior sagittal sinus, Straight sinus, Transverse sinus, Sigmoid sinus, Cavernous sinus, Sphenoparietal sinus, Petrosal sinus, Occipital sinus.





- The superficial veins drain mainly into the superior sagittal sinus which ultimately drains into the right IJV.
- The deep veins drain mainly into the great cerebral vein which ultimately drain into the left IJV.

➢ Important points :

- Artery of cerebral hemorrhage – Charcot's artery
- Charcot's artery – lenticulostriate artery
- Artery of cerebral thrombosis – anterior choroidal artery
- Commonest cause of intracerebral hemorrhage – ruptiure of charcot's artery
- The tight junctions between the endothelial cells of the blood capillaries form the most important component of blood brain barrier.

Regional Brain Syndromes

- Briefly describe typical syndrome associated with lesions in various areas of the brain.

➢ **Frontal lobe** :

A. unilateral injury:

1. may produce few clinical findings except with very large lesions

2. bilateral or large unilateral lesions: apathy, abulia (lack of ability to act or to make decisions)

3. the frontal eye field (for contralateral gaze) is located in the posterior frontal lobe (Br. area 8). Destructive lesions impair gaze to the contralateral side (patient looks towards the side of the lesion), whereas irritative lesions (i.e. seizures) cause the center to activate, producing contralateral gaze (patient looks away from the side of the lesion).

B. bilateral injury: may produce apathy, abulia

C. prefrontal lobes control "executive function": planning, prioritizing, organizing thoughts, suppressing impulses, understanding the consequences of decisions

- **Parietal lobe** :

  A. either side: cortical sensory syndrome, sensory extinction, contralateral homonymous hemianopia, contralateral neglect

  B. *dominant* parietal lobe lesion (left in most): language disorders (aphasias), Gerstmann's syndrome (Acalculia, finger agnosia, agraphia, right left vconfusion), bilateral astereognosis

- C. *non-dominant* parietal lobe lesions: topographic memory loss, anosognosia (lack of insight) and dressing apraxia

- **Occipital lobe**: homonymous hemianopsia

- **Cerebellum** : A. lesions of the cerebellar *hemisphere* cause ataxia in the ipsilateral limbs

  B. lesions of the cerebellar vermis cause truncal ataxia

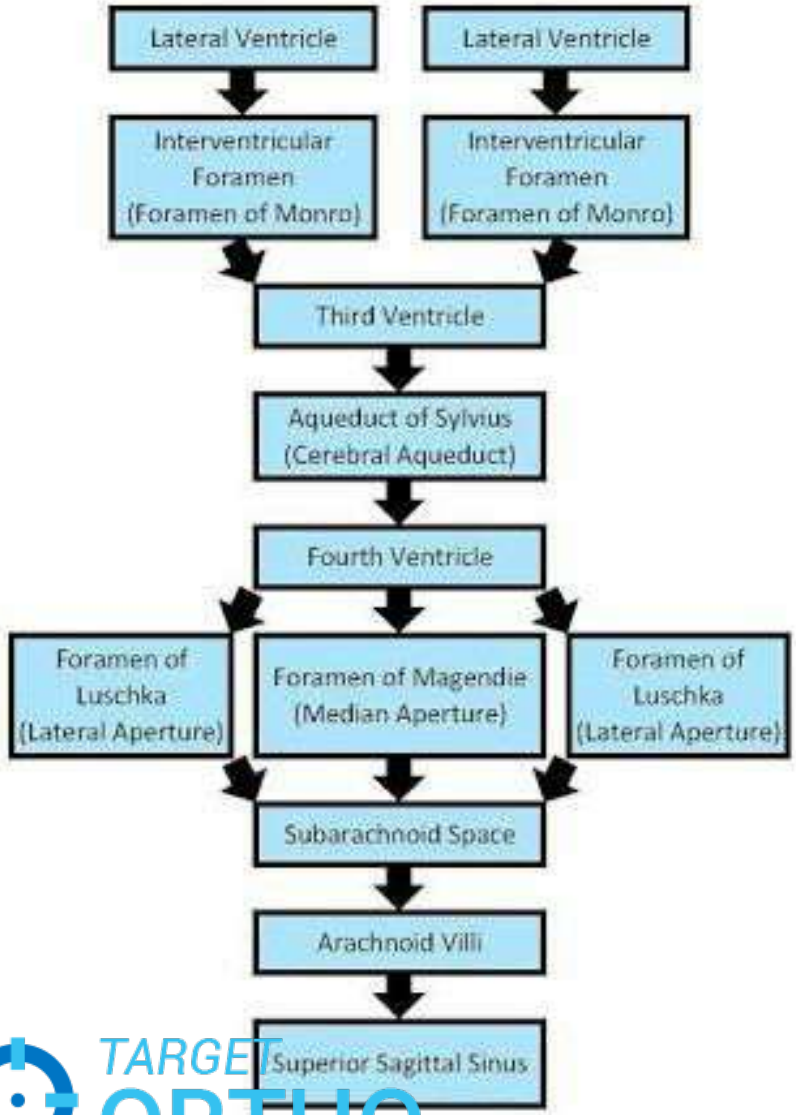
- **Brainstem**: usually produces a mixture of cranial nerve deficits and long tract findings (corticospinal tracts)

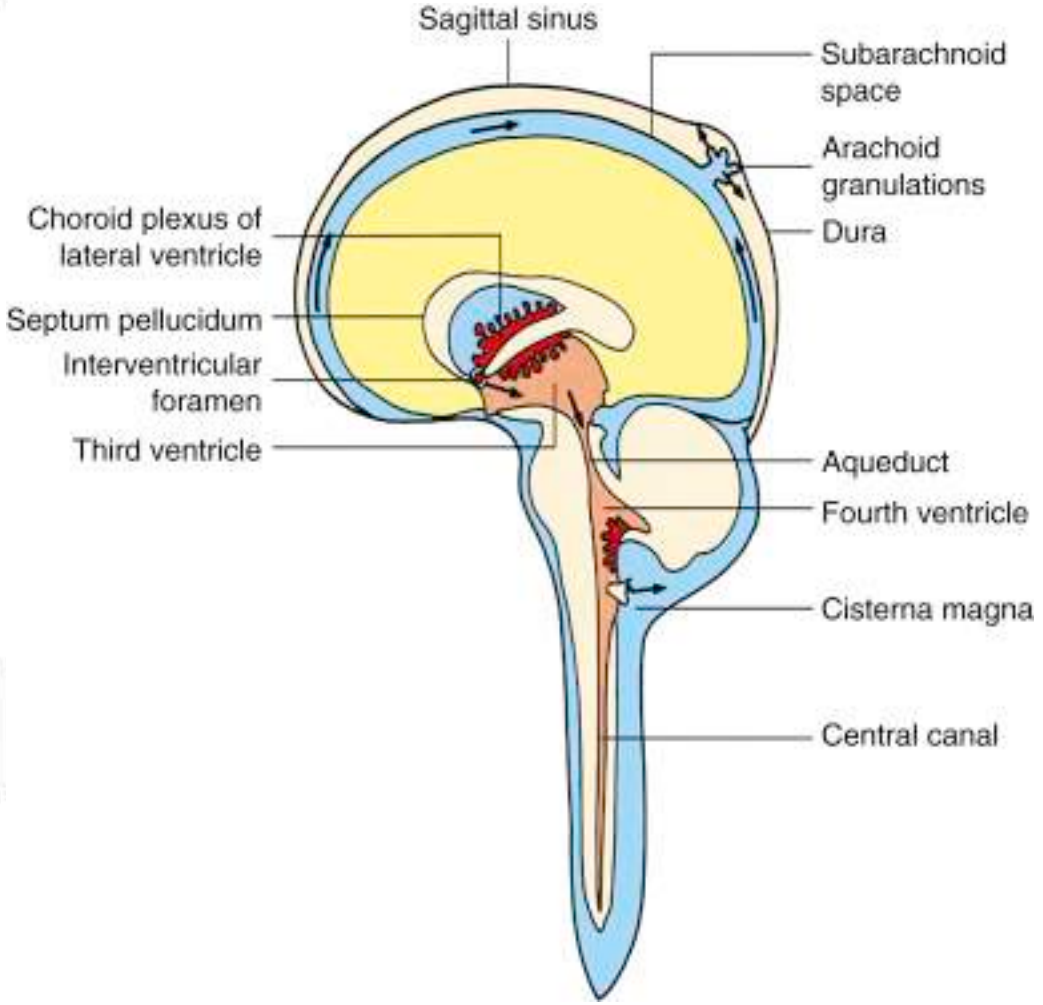
- ***WEBER'S SYNDROME*** : Cr. N. III palsy with contralateral hemiparesis . Third nerve palsies from parenchymal lesions may be relatively pupil sparing.
- ***BENEDIKT'S SYNDROME*** : Similar to Weber's, plus red nucleus lesion. Cr. N. III palsy with contralateral hemiparesis except arm which has hyperkinesia, ataxia, & a coarse intention tremor. Lesion: midbrain tegmentum involving red nucleus.
- ***MILLARD-GUBLER SYNDROME*** : Facial (VII) & abducens (VI) palsy + contralateral hemiplegia (corticospinal tract) from lesion in base of pons (usually ischemic infarct, occasionally tumor).
- ***PARINAUD'S SYNDROME : D***orsal midbrain syndrome, AKA pretectal syndrome - Supranuclear upward gaze palsy, lid retraction (Collier's sign), convergence palsy , accommodation palsy, seesaw nystagmus, dissociated light-near response (pseudo-Argyll Robertson)

FACTS TO REMEMBER

- **Pachymeninx:** Dura mater
- **Leptomeninges:** Arachnoid and pia mater
- **Toughest meninx:** Dura mater
- **Most delicate meninx:** Pia mater
- **Largest cistern of brain:** Cerebellomedullary cistern (cistern magna)
- **Most of CSF is formed by:** Choroid plexus of lateral ventricles
- **Cisterna ambiens:** Cistern of great cerebral vein
- **Virchow–Robin space:** Perivascular subarachnoid space
- **Longest fold of dura mater:** Falx cerebri
- **Clinically most important dural venous sinus:** Cavernous sinus
- **Commonest cause of congenital hydrocephalous:** Stenosis of cerebral aqueduct
- **Commonest site of subarachnoid haemorrhage:** Basal cistern (interpeduncular cistern)
- **Largest component of ventricular system:** Lateral ventricles
- **Narrowest part of ventricular system:** Cerebral aqueduct

Circulation of Cerebrospinal Fluid (CSF)





CSF

- The amount of CSF volume produced per day for adults is 450 to 750 mL/day (Single option to choose is 500 ml) and newborns is 25 mL/d.
- Rate of CSF formation mL/min in adults - 0.3 to 0.5 ml/min
- CSF pressure in a patient in lateral decubitus position in the following age groups :
  - newborn 9 to 12 cm H2O
  - 1 to 10 years old < 15 cm H2O
  - Adult < 18 (7 to 15) cm H2O
- Normal CSF has 0-5 lymphocytes and zero polymorphonuclear leucocytes (PMN) , zero red blood cells (RBCs).
- White blood cells (WBCs) above 5-10 is suspicious and above 10 is definitely abnormal.
- The sites of greatest absorption are the arachnoid villi.

Q. % of the CSF entering in the spinal subarachnoid space is :

A. 20%

B. 30%

C. 10%

D. 40%

Ans. A (20%)

Q. A patient having following values

SBP = 110 mmHg , DBP = 70 mmHg , ICP = 10 mmHg , has cerebral perfusion pressure (CPP) of :

A. 63 mmHg

B. 73 mmHg

C. 83 mmHg

D. 93 mmHg

Ans. B.

CPP = MAP – ICP

= (DBP + SBP – DBP/3) – ICP

Q. About Dandy Walker syndrome :

A. Agenesis of Vermis

B. Dilatation of IVth ventricle

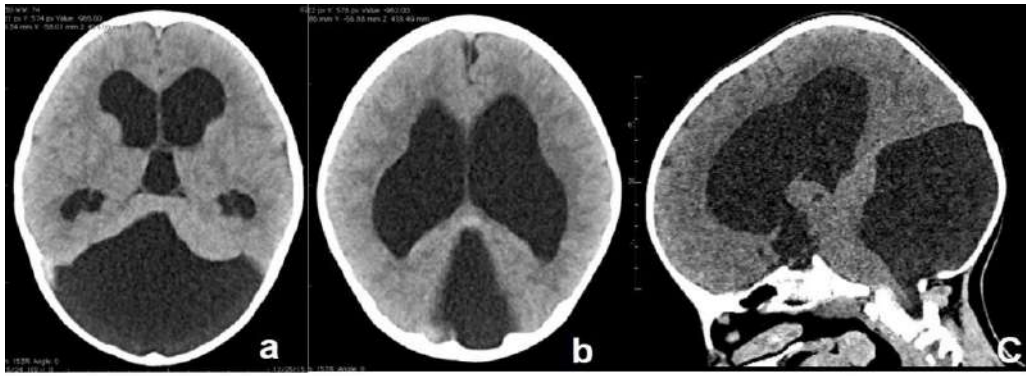
C. Small posterior fossa

D. High torcula (confluence of sinuses)

E. Atresia of Foramen Magendie and Luschka

Ans. A, B, D and E

- Atresia of foramina of Magendie and Luschka result in agenesis of the cerebellar vermis with a large posterior fossa cyst communicating with an enlarged IVth ventricle.
- Do not have vermian agenesis and the cyst does not open into 4th ventricle.
- Hydrocephalus occur in 90% of cases.



Q. Which out of the following is the direct content of cavernous sinus?

A. 3rd cranial nerve

B. 4^{th} cranial nerve

C. 6^{th} cranial nerve

D. Ophthalmic division of trigeminal nerve

Ans : C (6^{th} cranial nerve i:e abducent nerve)

Explanation :

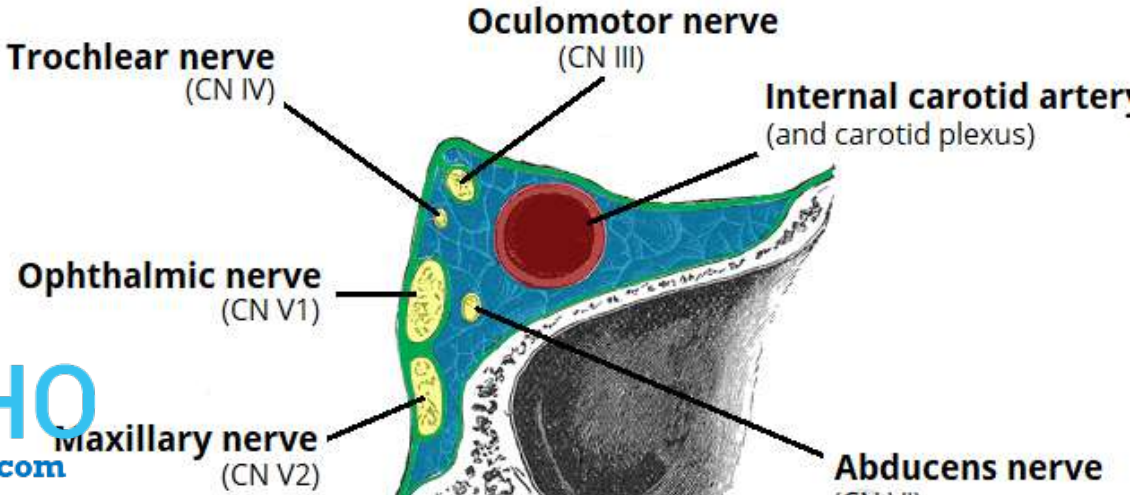
- The human brain is a highly vascular organ responsible for coordinating a myriad of processes throughout the body. Therefore, it is important that a pathway exists to return blood that enters the cranium to systemic circulation.

- The cavernous sinuses are one of several drainage pathways for the brain that sits in the middle. In addition to receiving venous drainage from the brain, it also receives tributaries from parts of the face.
- The left and right cavernous sinuses communicate by through the anterior and posterior intercavernous sinuses. The cavernous sinus drains to the superior and inferior petrosal sinuses, which then join the sigmoid sinus.
- The cavernous sinuses are located within the middle cranial fossa, on either side of the **sella turcica** of the sphenoid bone (which contains the pituitary gland). They are enclosed by the endosteal and meningeal layers of the dura mater.

Contents of cavernous sinus :

Several important structures pass through the cavernous sinus to enter the **orbit**. They can be sub-classified by whether they travel through the sinus itself, or through its lateral wall.

Travels though the cavernous sinus	Travels through lateral wall of cavernous sinus
• Abducens nerve (cn vi)	• Oculomotor nerve (cn iii)
• Carotid plexus (post-ganglionic sympathetic nerve fibres)	• Trochlear nerve (cn iv)
• Internal carotid artery (cavernous portion)	• Ophthalmic (v1) and maxillary (v2) branches of the trigeminal nerve



Q. Trigonocephaly results from :

A. Unilateral fusion of coronal suture

B. Bilateral fusion of coronal suture

C. Sagital suture premature fusion

D. Metopic suture fusion

Ans : D

Metopic craniosynostosis / Trigonocephaly - is premature closure of metopic suture - forehead is shaped like a triangle (keel of a boat)

- **Craniosynostosis** refers to the premature closure of the cranial sutures . The skull shape then undergoes characteristic changes depending on which suture(s) close early.
- There is a 3:1 male predominance.
- 8% of cases are syndromic or familial. Apert's syndrome, carpenter synrome, crouzon syndrome.

❑ Ages of normal sutural/fontanelle closure :

- Anterior fontanelle : 18-24 months
- sphenosquamosal: 6-10 years
- sphenofrontal: approximately 15 years
- occipitomastoid: approximately 16 years
- sagittal: approximately 22 years
- coronal: approximately 24 years
- lambdoid: approximately 26 years
- squamosal: approximately 60 years

Types :

- Brachycephaly: bicoronal and/or bilambdoid sutures
- Scaphocephaly/dolichocephaly: sagittal suture
- Plagiocephaly: unilateral coronal and lambdoid sutures
  - frontal plagiocephaly: unilateral coronal suture
  - occipital plagiocephaly: unilateral lambdoid suture

- The sagittal suture is most commonly involved (≈50%), where the lateral growth of the skull is arrested while anteroposterior growth continues, producing a narrowly elongated skull known as scaphocephaly (meaning boat-shaped) or dolichocephaly(from the ancient Greek for long ; dolichos).
- The next most common sutures in terms of involvement are:

  coronal (~20%)

  lambdoid (~5%)

  metopic (~5%)

- Treatment is often with a cranioplasty. Abnormal intracranial pressure may affect neurocognition.

Q. Most common location for an Arachnoid cyst :

A. Sylvian fissure

B. Interhemispheric

C. Sellar and suprasellar

D. Cerebellopontine angle(CPA)

Ans : A

(Sylvian fissure

15.1.3 Distribution

Almost all occur in relation to an arachnoid cistern (exception: intrasellar, the only one that is extradural, ▶ Table 15.1).

Table 15.1 Distribution of arachnoid cysts[3]

Location	%
Sylvian fissure	49
CPA	11
supracollicular	10
vermian	9
sellar & suprasellar	9
interhemispheric	5
cerebral convexity	4
clival	3

- **Also known as Leptomeningeal cysts,** are congenital lesions that arise during development from splitting of arachnoid membrane (thus they are technically intra-arachnoid cysts) and contain fluid that is usually identical to CSF.
- They do not communicate with the ventricles or subarachnoid space. May be unloculated or may have septations.
- Typically lined with meningothelial cells positive for epithelial membrane antigen (EMA) and negative for carcinoembryonic antigen (CEA).
- Comprise ≈ 1% of intracranial masses.
- Most ACs are asymptomatic. Those that become symptomatic usually do so in early childhood.

Treatment :

- Recommendation for incidentally discovered arachnoid cyst in adults: a single follow-up imaging study in 6–8 months is usually adequate to rule-out any increase in size. Subsequent studies only if concerning symptoms develop.

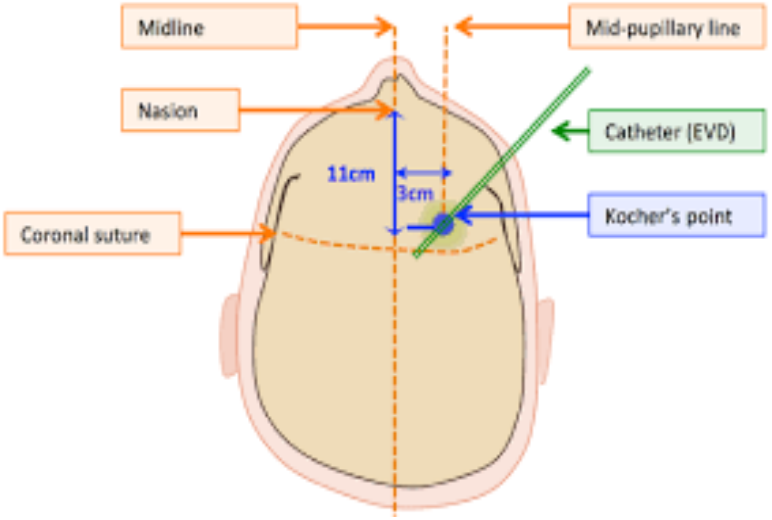
Q . Kocher point in skull can be identified as :

A. Being 5 cm in front of pinna

B. Being 5 cm behind coronal suture

C. Being 1 cm anterior to coronal suture

D. Being in front of Inion



Ans : C

- Kocher's point - this point localizes an entry point into the frontal horn of lateral ventricle that passes anterior to the motor strip.
- Often employed for ICP monitors, External ventricular drain, shunts and ventriculoscopies etc.
- Commonly cited landmark of this point is 2-3 cm from the midline which is approximately the mid pupillary line with forward gaze, 1 cm anterior to the coronal suture which is approximately 11 cm up from the nasion.

OTHER RELEVANT AND IMPORTANT INSERTION POINTS USED FOR CSF DIVERSION ARE :

- **FRAZIER POINT** (Occipito-parietal region) : 3–4 cm from midline, 6–7 cm above inion.
- **KEEN'S POINT** (Posterior Parietal region): 2.5–3 cm posterior and 2.5–3 cm superior to pinna.
- **DANDY'S POINT** : 2 cm from midline, 3 cm above inion (may be more prone to damage visual pathways than above).
- **KAUFMAN'S POINT :** 5 cm superior to the nasion and 3 cm lateral to midline.
- **PAINE'S POINT :** The point of an isosceles triangle, whose two limbs each measure 2.5 cm and whose base is located along the Sylvian veins.
- **TUBB'S POINT :** The trajectory points 45 degrees away from a horizontal line and 15–20 degrees medial to a vertical line, passing through the top of the orbit at a location just medial to the mid pupillary point.

Q. A 15-year-old boy presents to the emergency department after a drowning. He is intubated and on mechanical ventilation on arrival. He is unresponsive. Vital signs reveal hypotension and hypothermia with tachycardia. On neurological examination, his brainstem reflexes are absent. The apnea test does not show any spontaneous respiratory drive. What is the next best step in the management of this patient?

A. Declare brainstem death

B. Perform cerebral angiography

C. Repeat brainstem reflexes and apnea test after 6 hours

D. Repeat brainstem reflexes and apnea test after 12 hours

Ans : D

- In patients who present with the absence of brainstem reflexes after a drowning, hypothermia can be one of the confounding factors.
- The most rational approach is to perform and validate both the brainstem reflexes and the apnea test through repeat examination after 12 hours.
- it is prudent to watch for pitfalls and confounding factors such as drugs, intoxication, hypotension, hypothermia, etc while evaluating brain stem functions.
- Cerebral angiography is not required if both the brainstem reflexes and the apnea test criteria are correctly fulfilled

Vital signs & general criteria
● Core temp > 36 °C (96.8 °F)
● SBP ≥ 100mm Hg (with or without pressors)
● Absence of drugs that could simulate brain death (e.g. NMBAs, drug intoxication, blood alcohol content (BAC)should be < 0.08%…)
•**Absence of brainstem reflexes**

Fixed pupils
Absent corneal reflexes
Absent oculovestibular reflex (calorics
Absent oculocephalic reflex: “Doll’s eyes
Absent gag reflex
Absent cough reflex
Absence of any cerebrally mediated response to auditory and tactile noxious stimulation periphrally and in the cranium
Apnea confirmed with apnea challenge

❑ Ancillary confirmatory tests for Brain Death :

- Cerebral Angiography
- EEG
- Cerebral radionuclide angiogram (CRAG)
- MRA, CTA
- Transcranial doppler

Q. Best Motor response M5 in GCS stands for :

A. Decerebrate

B. Withdraws to pain

C. Decorticate

D. Localizes the pain

Ans : D

- The Glasgow Coma Scale (GCS) is a widely used scoring system with good repeatability(note: the scale is used to assess level of consciousness and is not designed for following neurologic deficits).
- General practice is to record a “T” (for “intubated”) next to the verbal score and the total score for patients whose verbal axis cannot be assessed because of intubation.
- No single GCS score defines a cutoff for coma, however, 90% of patients with GCS≤ 8 and none with GCS≥ 9 meet the above definition of coma. Thus, GCS≤ 8 is a generally accepted operational definition of coma.
- This scale is recommended for age ≥ 4 yrs

Glasgow Coma Scale

BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1
Total score:	*Best response*	15
	Comatose client	8 or less
	Totally unresponsive	3

Decorticate posturing - Classically attributed to disinhibition by removal of corticospinal pathways *above the midbrain*. Overview: abnormal flexion in UE and extension in LE.

Decerebrate posturing - Classically attributed to disinhibition of vestibulospinal tract (more caudal) and pontine reticular formation (RF) by removing inhibition of medullary RF (transection at intercollicular level, between vestibular and red nuclei). Overview: abnormal extension in UE and LE.

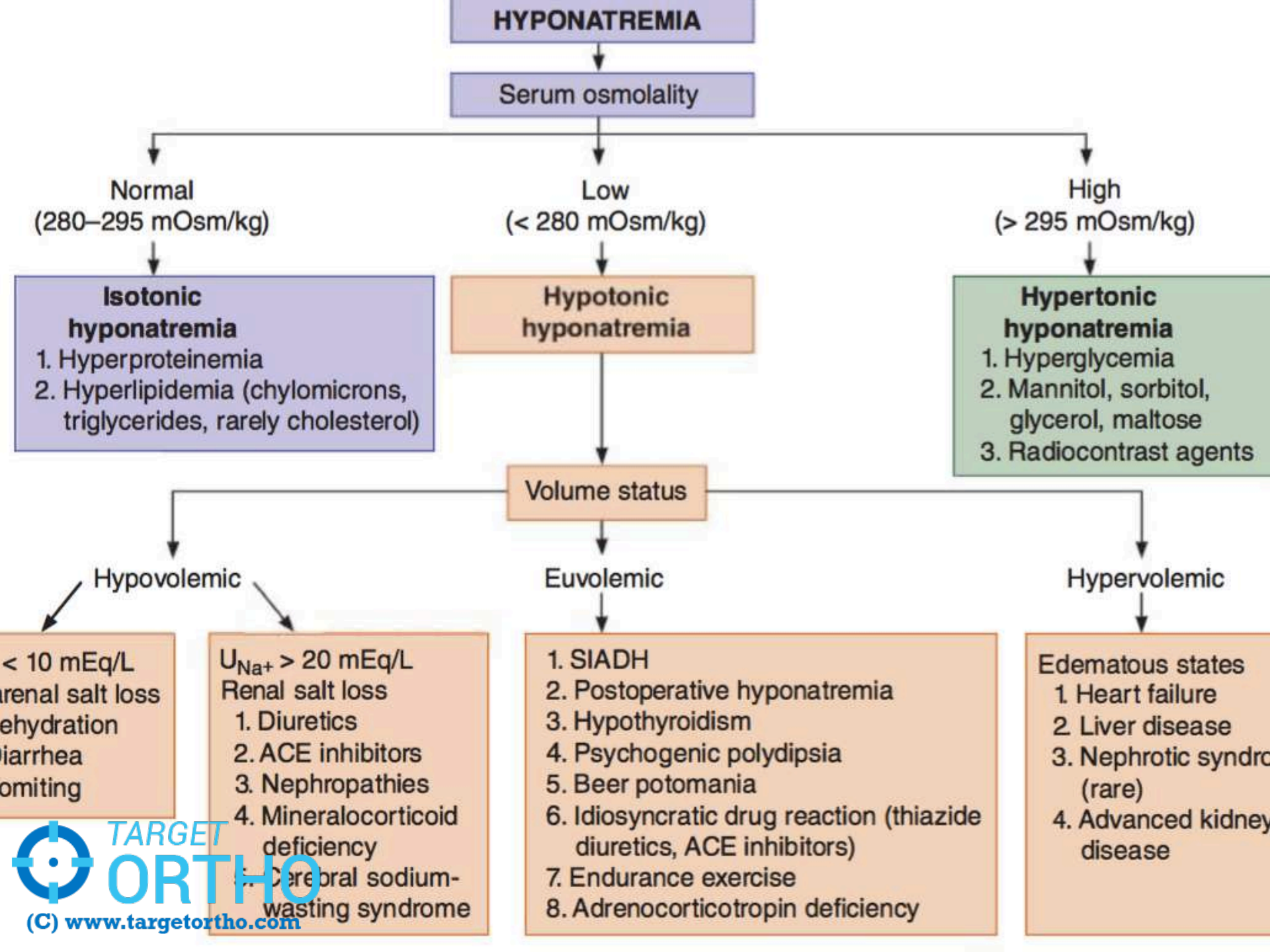
Pediatric coma scale for assessing consciousness in Non verbal children

Eye and motor response assessed same as in GCS

Nonverbal Children	Best Verbal Response(as in the Glasgow scale)	Score
smiles oriented to sound follows objects interacts	Oriented and converses	5
consolable when crying and interacts inappropriately	Disoriented and converses	4
inconsistently consolable and moans; makes vocal sounds	Inappropriate words	3
inconsolable irritable and restless; cries	Incomprehensible sounds	2
No response	No response	1

Diabetes insipidus (DI) Vs SIADH

DI	SIADH
There is not enough ADH in the body	Body is making too much ADH
Without ADH to tell the body to hold onto the water the kidneys produce Huge amounts of urine → leads to fluid volume deficit	With too much antidiuresis the kidneys stop excreting water and hold onto it, thus decreased urine output → leads to retention of water in the intravascular space. Only water is retained , NO Sodium, body remains euvolemic
Urine specific gravity : Low	High
Urine osmolality : Low	High
Serum Sodium : High	Low
Serum Osmolality : High	Low



Q. The most common site of Intracerebral hemorrhage is

A. Putamen

B. Cerebellum

C. Thalamus

D. Lobar

Ans. A

Q. The physiological calcification is seen in :

A. Arachnoid granulation

B. Choroid plexus

C. Pteroclinoid ligament

D. Habenular commisure

E. Vein of Galen

Ans. A to D

Q. Characteristic “Popcorn” appearance seen on T2WI on MRI is seen in which vascular malformation :

A. AVM

B. Cavernous angioma

C. Venous angioma

D. Capillary telangiectasia

Ans. B

Q. “Medusa Head” appearance is seen on cerebral angiography in which vascular malformation:

A. AVM

B. Cavernous angioma

C. Venous angioma

D. Capillary telangiectasia

Ans. C

Q. The most common artery and lobe to be involved in AVM are :

A. Middle cerebral artery and Temporal lobe

B. Anterior cerebral artery and Frontal lobe

C. Posterior cerebral artery and Occipital lobe

D. Middle cerebral artery and Parietal lobe

Ans : D

- MCA and Parietal lobe: The parietal lobe is the commonest region involved in the supratentorial lesions. There is no significant hemispheric preference. Middle cerebral artery is the most common artery to be involved in AVM.

Hydrocephalus

- Is dilation of the cerebral ventricles caused by blockage of the CSF pathways.
- It is characterized by excessive accumulation of CSF in the cerebral ventricles or subarachnoid space.
- **Noncommunicating hydrocephalus** results from obstruction within the ventricles (e.g., congenital aqueductal stenosis).
- **Communicating hydrocephalus** results from blockage within the subarachnoid space (e.g., adhesions after meningitis).
- **Normal-pressure hydrocephalus** occurs when the CSF is not absorbed by the arachnoid villi, possibly secondary to posttraumatic meningeal hemorrhage. It is characterized clinically by the triad of progressive dementia, ataxic gait, and urinary incontinence (wacky, wobbly, and wet).
- **Hydrocephalus ex vacuo** results from a loss of cells in the caudate nucleus (e.g., Huntington disease).
- **Pseudotumor cerebri (benign intracranial hypertension)** results from increased resistance to CSF outflow at the arachnoid villi. It is characterized by papilledema without mass, elevated CSF pressure, and deteriorating vision. The ventricles may be slit-like. It usually occurs in obese young women.

Development of Nervous bsystem

Q. A newborn has multiple congenital defects due to dysgenesis of the neural crest. Which of the following cells is most likely to be spared?

(A) Dorsal root ganglion cells

(B) Geniculate ganglion cells

(C) Melanocytes

(D) Motor neurons

Ans : D

- Motor neurons develop from the neural tube, more specifically from the basal plate. The other options are derivatives of the neural crest.
- Central nervous system (CNS) begins to form in the third week of embryonic development as the neural plate. The neural plate becomes the neural tube, which gives rise to the brain and spinal cord.

- Peripheral nervous system (PNS) consists of spinal, cranial, and visceral nerves and spinal, cranial, and autonomic ganglia.
- Is derived from three sources:

1. Neural crest cells - give rise to peripheral ganglia, Schwann cells, and afferent nerve fibers.
2. Neural tube gives rise to all preganglionic autonomic fibers and all fibers that innervate skeletal muscles.
3. Mesoderm gives rise to the dura mater and to connective tissue investments of peripheral nerve fibers (endoneurium, perineurium, and epineurium).

- Neural tube forms as the neural folds fuse in the midline and separate from the surface ectoderm. It lies between the surface ectoderm and the notochord.

1. The cranial part becomes the brain.
2. The caudal part becomes the spinal cord.
3. The cavity gives rise to the central canal of the spinal cord and ventricles of the brain.
4. The two openings in the neural tube connect the central canal with the amniotic cavity:

a. Anterior neuropore - closes in the fourth week (day 25) and becomes the lamina terminalis.

b. Posterior neuropore - closes in the fourth week (day 27).

- Neural crest gives rise to: Pseudounipolar ganglion cells of the spinal and cranial nerve ganglia **, Schwann cells** (neurolemmal sheath cells that form myelin in the PNS) , Multipolar ganglion cells of the autonomic ganglia , **Leptomeninges (pia–arachnoid cells**) , Chromaffin cells of the suprarenal medulla , **Pigment cells (melanocytes**), Odontoblasts (dentin-forming cells), dental papilla, and the dental follicle , Aorticopulmonary septum of the heart, Parafollicular cells (calcitonin-producing C-cells) , Skeletal and connective components of the pharyngeal arches.

- Anterior lobe of pituitary (adenohypophysis) develops from the Rathke pouch, an ectodermal diverticulum of the primitive oral cavity (stomodeum). Remnants of the Rathke pouch may give rise to a congenital cystic tumor, a craniopharyngioma .
- Posterior lobe (neurohypophysis) develops from a ventral evagination of the hypothalamus

Imaging

- The best sequence for CVA is FLAIR on MRI which stands for fluid-attenuated inversion recovery
- Cerebrospinal fluid (CSF) is black in FLAIR sequence.Most lesions appear Bright in this sequence.
- The best MRI sequence for **acute SAH is FLAIR and for old blood is gradient echo.**
- An MRI sequence that summates T1 and T2 signals and causes fat to be suppressed is called the STIR (short tau inversion recovery) sequence.
- **Diffusion weighted images (DWI) on MRI :**

  - Its primary use is to detect ischemia

  - On DWI, freely diffusible water is dark and Restricted diffusion is bright (which is abnormal).

  - Restricted perfusion usually indicates cell death

  - DWI abnormally will be present for 1 month

  - DWI abnormalities can light up within minutes of ischemia

- The most sensitive study for ischemia of the brain is the **PWI (Perfusion Weighted Imaging).**
- DWI and PWI mismatch identifies penumbra (reversible cell injury)**.**

❑ **Stroke in young adults:**

- Only 3% of ischemic strokes occur in patients who are <40 years-old.
- Most common cause is trauma, 22%.

Aneurysmal SAH(Subarachnoid hemorrhage)

- What percentage of patients die before reaching the hospital? → 10-15%
- What is the risk of rebleeding within 2 weeks? → 15-20%
- What is the risk of death from vasospasm? → 7%
- What is the risk of severe deficit from vasospasm? -→ 7%
- What is the 30-day mortality rate? → about 50%
- What is the strongest prognostic indicator? → severity of clinical presentation

- **Percentage incidence of cerebral aneurysm for each of the following:**

  A-comm 30%, P-comm 25% , MCA 20%

  posterior circulation 15% , basilar 10%

  multiple 20-30%

- AVMs most commonly present with hemorrhage. Another common presentation is seizures.
- Small AVMs present more often as hemorrhage; whereas large AVMs present with seizures.
- Average risk of hemorrhage from an AVM is 2-4 % per year.
- **MRI characteristics of AVMs:**
  a. Flow voids on T1- or T2- weighted imaging.
  b. Presence of edema can help differentiate AVM from tumor.
  c. A complete hemosiderin ring suggests AVM over tumor.
  d. What sequence on MRI best shows hemosiderin? → gradient echo

- Spetzler-Martin grading is used for AVMs. Graded features of an AVM include size, eloquence of adjacent brain and pattern of venous drainage.

❑ Venous Angioma :

- Also known as developmental venous anomaly (DVA)
- Demonstrable on angiography as starburst pattern.
- Seizures and hemorrhage are rare.
- Are low flow and low pressure lesions.
- Usually no treatment needed.

❑ **Angiographically occult vascular malformation (AOVM) presentation:**

- The incidence of angiographically occult vascular malformations is 10%.
- They most often present with seizures or headache rather than hemorrhage.
- The most common angiographically occult vascular malformation is AVM.

❑ **Cavernous malformation** :

- Most often present with seizures.
- They are angiographically occult
- Account for 5-13% of all CNS vascular malformations.
- Present with :
  seizures in 60%. seizures
  progressive neurological deficit in 50%.
  Hemorrhage in 20%
  incidental finding in 50%.
- Risk of significant bleeding is 2-3 % per year.
- Bleeding risk is higher in females.
- The most sensitive test is b. The most sensitive sequence is Gradient-echo T2WI MRI
- Display a pathognomonic popcorn pattern.

Q. **Which of the following AV malformations do not have intervening brain parenchyma**

a. Cryptic AV malformation

b. Cavernous hemangioma

c. Capillary telangiectasia

d. Developmental venous anomalies

Ans : B

Cavernous Hemangioma or cavernoma do not have intervening brain parenchyma

❑ **Dural arteriovenous fistula (DAVF)** :

- Arteriovenous shunt is contained within the duramater.
- Most common location is transverse/sigmoid sinus.
- Considered to be acquired rather than congenital lesions.
- Primary etiology is venous sinus thrombosis.
- Most common presenting symptom is pulsatile tinnitus.
- Cortical venous drainage with venous hypertension is the most common cause of morbidity and mortality, and thus is the strongest indication for treatment.
- DSAis required to establish the diagnosis.

Brain abscess

- Are most commonly polymicrobial.
- Risk factors : pulmonary abnormalities , congenital cyanotic heart disease ,bacterial endocarditis , penetrating head trauma , chronic sinusitis , otitis media , immunocompromised host .
- Percentage of cerebral abscesses where no source found - 25% of cases
- Most common origin for hematogenous spread - chest
- Ethmoidal and frontal sinusitis leads to an abscess in frontal lobe
- Infants less likely to develop a brain abscess following purulent sinusitis due **to Lack of aerated sinuses and air cells**.
- The most common organism is **Streptococcus.**
- The most common organism in traumatic causes is Streptococcus aureus
- The most common organisms in transplant patients are fungal infections
- The most common organisms following neurosurgical procedures are Staphylococcus epidermidis and Staphylococcus aureus.

- Four stages of cerebral abscess :

  Early cerebritis (1-3 days) - inflammation

  Late cerebritis (4-9 days)- necrotic centre

  Early capsular stage (10-13 days)- neovascularity,

  Late capsular stage (> 14 days)- gliosis around collagen capsule
- MRI good for staging cerebral abscess.
- **Antibiotics used** IV x 6-8 wks followed by oral x 4-8 wks, although duration should be guided by clinical and radiographic response.
- Medical therapy alone is more successful for the treatment of abscesses if it is in early cerebritis stage (before complete encapsulation), the abscess is less than 3 cm in diameter and symptom duration is less than 2 weeks.

CSF Rhinorrhoea

- Most accurate confirmatory test is β2-transferrin.
- **CT Cisternography** is the test of choice for localizing site of fistula.
- Acutely after trauma, **observation** is justified as most cases cease spontaneously. Usual time period for observation is 2 weeks.

Q. Which cranial nerve is supplied by ECA :

A. II
B. V
C. VI
D. VII

Ans: D

- The external carotid artery is the artery of head and neck. It supplies facial nerve (CN VII).

Q. **Sequence of clamp removal after carotid endarterectomy :**

a. ECA, CCA, ICA

b. ECA, ICA, CCA

c. CCA, ECA, ICA

d. CCA, ICA, ECA

Ans : A

- After closure of the arteriotomy, the superior thyroid artery vessel loop is removed to allow back bleeding while the final prolene suture is placed. Then ECA and CCA clamps are removed to clear any remaining debris through the external system and then the ICA clamp is removed.
- Carotid endarterectomy may be better than medical management if stenosis is **>60%. (in case of asymptomatic carotid stenosis)**
- Carotid endarterectomy (CEA) for symptomatic carotid stenosis >70% reduces strokes by 17% at 18 months and reduces death by 7% at 18 months.

Q. A lesion affecting the left optic tract will be manifested by a deficit in the :

A. Nasal half of the visual field of both eyes

B. Nasal half of the right visual field and temporal half of the left visual field

C. No deficits unless the right optic tract was also affected

D. Temporal half of the right visual field and nasal half of the left visual field

Ans: D

- After the optic chiasma, all the field defects affect the homonymous field of the opposite side.
- Meaning that with a lesion in left optic tract, a person will not be able to see the right half of visual fields in both the eyes. This field on right side is the temporal field and the left side is the nasal field.

THANK YOU