



# ANATOMY & SURGICAL APPROACHES TO LATERAL VENTRICLES

# Anatomy

- Two paired cavities
- C Shaped
- Each cavity contains about 10 ml CSF
- Divided into:
  - **Frontal horn** (Length 6 cm)
  - **Body** between IVF and atrium
  - **Temporal horn** ( length 4 cm)
  - **Occipital horn**
  - **Atrium**

# Frontal horn

- Boundaries
  - Medial wall
    - Septum pellucidum
  - Roof, anterior wall and Floor
    - Anterior wrapping of the corpus callosum, genu, rostrum & trunk
  - Lateral wall
    - Internal aspect of the head of the caudate nucleus.

# Body

- Boundaries
  - Medial wall
    - Septum pellucidum & body of fornix
  - Roof
    - Body of corpus callosum
  - Lateral wall
    - Medial part of body of caudate nucleus
  - Floor
    - Dorsal surface of thalamus between thalamo-caudate sulcus and tenia thalami (attach line of choroidal plexus on thalamus)

# Atrium

- Confluence of horns.
- Communicates cranially, ventrally and medially with frontal horn, dorsally with occipital horn, & caudally, ventrally and laterally with inferior horn.
- Overlies the pulvinar, posterior pole of thalamus which constitutes anterior wall.
- Roof: fibers coming from the splenium .
- Medial wall: choroidal fissura with choroidal plexus (glomus); isolates the LV from the cisterna ambiens.

# Occipital horn

- Internal wall
  - 2 prominences formed cranially & inferiorly by fibers of splenium of corpus callosum & deep part of calcarine sulcus
- Floor
  - Bulged by collateral sulcus forming collateral eminence,
- Lateral wall
  - White matter of tapetum formed by external fibers of the splenium of corpus callosum, overlaid laterally by optic radiations and then inferior longitudinal fasciculus

# The temporal horn

- Floor
  - Hippocampus & caudally collateral eminence
- Roof
  - Inferior aspect of thalamus, tail of the caudate nucleus & deep white matter of temporal lobe,
- Medial wall
  - Choroidal fissura & choroid plexus clinging to the fimbria and to inferior aspect of the hemisphere
- The anterior extremity is situated just behind amygdaloid nucleus.

# Interventricular foramen

- Bounded on each side by anterior pole of thalamus and ventrally by anterior crus fornicis
- Diameter 3–4 mm & presents a posterior concavity
- Marked by reflexion of choroidal plexus of roof of third ventricle which continues with choroidal plexus of LV & venous angle between thalamostriate vein & internal cerebral vein.

# Arterial vasculature of the VL

- Anterior choroid artery
  - Arises from terminal segment of ICA closer to the origin of the PCoM than the carotid bifurcation
  - Two segments: cisternal and plexal
  - Frequently anastomoses with branches of other choroidal arteries
  - Sends branches to adjacent nervous structures
    - Optic tract, cerebral peduncle, globus pallidus, origin of optic radiations

## Posterior choroid artery

- The medial posterior choroid artery
  - Gives a few feeding vessels for the choroidal plexus of the VL except anterior anastomosis at the level of the interventricular foramen
  - Arises from the posterior cerebral artery (P1 segment)
  - Anastomoses are often found between the medial posterior choroidal artery and the lateral posterior choroidal artery through the interventricular foramen (IVF)

- The lateral posterior choroid artery
  - Number per hemisphere ranges from 1 to 9 (average 4)
  - Arises from either P2 or P3 segment of the PCA
  - Runs laterally to the PCA and enters the choroidal fissure
  - Area of distribution
    - Cerebral peduncle, fornix, pulvinar and caudate nucleus.

# Veins of the lateral ventricles

- Provide valuable landmarks in directing the surgeon to the foramen of Monro and choroidal fissure during operations on the ventricles
- The choroidal veins are bulky and tortuous, easily seen, run over the plexus
  - **Superior choroid vein** , very bulky, drains the glomus & runs ventrally towards the ventricle body to end close to the IVF either in the thalamostriate vein or in the ICV
  - **Inferior choroid vein** ends in the inferior ventricular veins and also in the basal vein at the same place.
  - **Medial choroid veins** course from the plexus of the ventricular body to the ICV

# Veins of the ventricular walls

- Medial wall of the LV
  - Anterior septal vein , the most constant, drains into the venous confluent of the IVF
  - Posterior septal veins
  - Medial atrial veins
  - Transversal veins of the hippocampus draining into the basal vein
  - Vein of the amygdaloid body draining into the basal vein or into a transversal vein of the hippocampus

- Veins of the lateral wall
  - Anterior caudate veins , draining into the thalamostriate vein
  - Thalamostriate vein , the most constant, runs in the thalamocaudate sulcus & forms the venous angle with the ICV through the IVF
  - Posterior caudate veins ending to the thalamostriate vein
  - Thalamocaudate vein joins the ICV before the atrium

# Key features

- Craniotomy flap placed so as to minimize brain retraction.
- Self retaining rather than handheld retractor
- Minimum Neural incision

- Internal debulking of tumor before separation.
- Preservation of arteries
- Minimal sacrifice of veins
- CSF diversion

## ➤ Anterior approaches

- Directed to frontal horn & body of lateral ventricle
  - Anterior transcallosal
  - Anterior transcortical
  - Anterior frontal

## ➤ Posterior approaches

- Directed to the atrium
  - Posterior transcallosal
  - Posterior transventricular

## ➤ Lateral approaches

- Directed to temporal horn
  - Pterional
  - Posterior frontotemporal
  - Subtemporal

# Transcallosal approach

- Indications:
  - Frontal horn tumors located mainly in the ventricle.
  - Minimal hydrocephalus
  - Tumor extending to both frontal horns and to third ventricle

# Positioning and craniotomy

- Supine position
- Lateral position
  - Ipsilateral approach
  - Contralateral approach
- Craniotomy
  - Cross midline
  - $2/3^{\text{rd}}$  anterior and  $1/3^{\text{rd}}$  posterior to coronal suture

# Surgical technique

- Reflect dura based on sinus
- Identify bridging veins and preserve
- Identify corpus callosum and ACAs
- Callosotomy

# Intraventricular orientation

- Choroid plexus and thalamostriate veins
- Foramen of monro
- Tumor identification
- Resection of tumor as internal debulking followed by dissection.

# Complications

- Vascular injury
  - Arachnoid granulations
  - Bridging veins
  - ACAs
- Corpus callosal syndrome
  - Reduced spontaneity of speech to frank mutism.
  - Interhemispheric transfer syndromes

# Advantages

- Less chances of Neural injury
- Access to both ventricles
- Less chances of epilepsy (?)
- Entry to third ventricle easy if required

# Disadvantages

- More chances of Vascular injury
- Theoretical risks of callosotomy
- Superiorly located tumors are generally can not be tackled.

# Transcortical approach

- Indication:
  - Tumor growing outside the ventricle
  - Tumor located mainly in antero-superiorly in frontal horn
  - Non-dominant hemisphere
  - Surgeons preference

# Positioning and craniotomy

- Principles followed are same
- Craniotomy in middle frontal gyrus
- Entry in ventricle
- Tumor debulking and dissection

# Complications

- Epilepsy
  - Direct cortical incision and damage
- Memory loss
  - Retraction of caudate nucleus.
- Hemiplegia
  - Retraction of centralis semiovalis

# Disadvantages

- More chances of epilepsy and porencephalic cysts
- Limited entry to opposite ventricles
- Small ventricles- chances of missing

# Tumors involving the body

- Transcallosal approach is better
- Combined transcallosal and transcortical approach is needed for large tumors involving both ventricles

# Atrial tumors

- Transcortical approach is favored.
- Lateral decubitus position with face turned towards the floor
- Superior parietal lobule is identified
- 1-2 cm cortisectomy

# Why transcortical approach preferred?

- Ventricles diverge posteriorly
- Splenium sacrifice has physiological risks
- PCA injury is more common

# Complications

- Speech problems
  - Acalculia, apraxia
- Visual field deficits
  - Homonymous hemianopia
  - Visual spatial processing
- Splenium syndrome
  - Interhemisphere disconnection syndrome

# Occipital approach

- Suitable for tumours situated in part of the pulvinar, medial occipital lobe, and medial atrial wall facing the quadrigeminal cistern
- Three-quarter prone position with occipital area to be operated lowermost and face turned toward the floor
- An atrial tumor that extends into the medial occipital cortex, near the junction of the vein of Galen and straight sinus, can be exposed by opening through the isthmus of the cingulate gyrus in front of the calcarine sulcus.

# Lateral approaches

- Frontotemporal / Post frontotemporal
  - Supine with head turned laterally
  - Small temporal craniotomy
  - Dura opened based on base

➤ Cortical incision

If the lesion is strictly localized to the region of the tip of the temporal lobe

➤ Temporal lobectomy

If the lesion not only involved the temporal pole but also extended into the temporal horn

➤ For the transcortical approach, lower part of middle temporal gyrus or upper part of inferior temporal gyrus is opened in the long axis of the gyrus & the incision is directed backward through the temporal lobe to the anterior part of the temporal horn

# Transtemporal / Subtemporal approaches

- Used for a lesion in the middle or posterior third of the temporal horn.
- Supine with head turned almost laterally .
- Small temporal craniotomy.
- Dura opened based on base.

- Cortical incision in the middle or inferior temporal gyrus anterior to the optic radiations.
  
- An alternative route
  - ▣ Subtemporal route, in which an incision is made in the inferior temporal or occipitotemporal gyrus or the collateral sulcus on the lower surface of the temporal lobe
  
  - ▣ Minimizes the possibility of damage to the optic radiations and speech centers of the dominant hemisphere

# Complications

- Visual field deficits
  - Superior quadrantonopia
- Language deficits
- Others
  - Dyslexia
  - Agraphia
  - Acalculia

THANKS