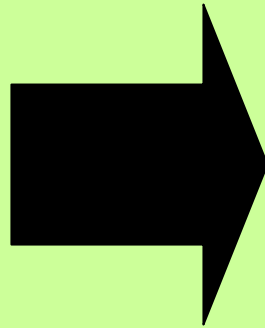


# **SURGICAL APPROACHES TO CAVERNOUS SINUS**

**Presentation – Amit Srivastava**

# ***INTRODUCTION***

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# Named by **RIDLEY** in 1895.

# 1<sup>st</sup> surgical excursion credited –  
**KROGIUS** in 1895.



# Considered – **NO MAN'S LAND**

# In 1965, **PARKINSON** showed that it  
is possible to surgically approach.

# **SURGICAL ANATOMY OF CAVERNOUS SINUS**

- Hexadron- shaped space
- Either side of sella turcica
- Along convergence of the sphenoid bone & petrous bone.
- Walls of cavernous sinus is shaped by DURA MATER  
from – middle  
-posterior } *CRANIAL*  
                  } *FOSSA*  
                  } *BASE*  
-tentorium

*Surgical anatomy of cavernous sinus is best explained under following headings –*

*1) Bony relationships*

*2) Dural relationships*

*3) Venous relationships*

*4) Neural relationships*

*5) Arterial relationships*

# **BONY RELATIONSHIPS**

**ANTERIOR** – *Optic strut/ Anterior clinoid process/ Lesser wing of sphenoid*

## **MEDIAL** –

- Caroticoclinoid foramen*
- middle clinoid process*
- Pituitary fossa*
- Body of sphenoid*
- Carotid sulcus*

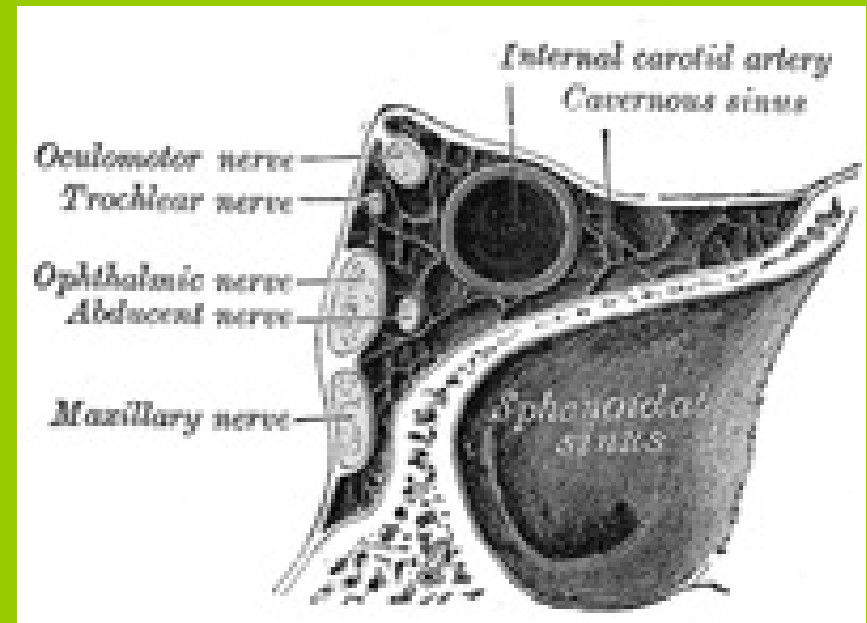
## **LATERAL** –

- Greater wing of sphenoid*
- Foramen*
  - rotundum*
  - ovale*
  - spinosum*

**POSTERIOR** – *Posterior clinoid process/ Dorsum sella/ Petrous apex/ Trigeminal impression*

# ***DURAL RELATIONSHIPS***

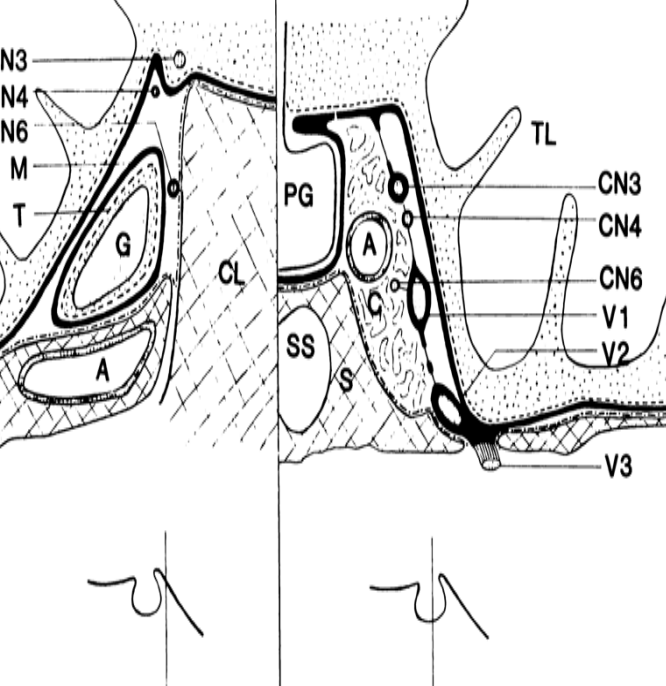
***Floor & Medial wall*** – formed by single periosteal layer of dura, supero- medially it continues with dura of sella turcica.



***Roof, Lateral & Posterior wall***- are double layered, formed by periosteal layer of dura + dura proper of middle & posterior fossa respectively.

-roof medially continues with Diaphragma sella.

-roof has multiple dural folds, formed by different bony processes- dural fold connection. Provide SHAPE to sinus.



*Postero- lateral part of cavernous sinus has **DIVERTICULUM OF MENINGES** of post. Fossa found over petrous apex*



## **Meckel's Cave**

*-lined by **outer layer of dura & inner layer of arachnoid***

*-filled with **CSF** ( **trigeminal cistern**)*

*- **contains gasserian ganglion.***

*- **SCHWANNOMA/ MENINGIOMA***

# ***VENOUS RELATIONSHIPS***

*Cavernous sinus* → **VENOUS PLEXUS OR VENOUS CHANNEL ?**



**Matter of debate**

*Surgically proven as* **VENOUS CHANNEL**

*-A pair of cavernous sinus, on either side of sella turcica.*

*- Interconnected with each other by 1) ANT.*

*INTERCAVERNOUS SINUS (large & consistent connection), 2)POST.*

*INTERCAVERNOUS SINUS ( small & sometimes absent), 3)BASILAR*

*PLEXUS (B/L also connected to SUP. & INF. PETROSAL SINUSES)*



## ***AFFERENT DRAINAGE – (IN)***

*1) Sphenoparietal sinus, 2) Sup. Ophthalmic vein, 3) Inf. Ophth. vein 4) Superficial Sylv. vein ( middle cerebral vein) 5) Middle meningeal vein. 6) Central retinal vein.*

## ***EFFERENT DRAINAGE – (OUT)***

*1) Sup. & Inf. Petrosal sinus, 2) plexus of vein on ICA, drains into Pterigoid plexus of vein, 3) Emissary veins of Sphenoid foramen, foramen ovale, foramen lacerum.*

***DANGER AREA OF FACE*** – *medial canthus, nasal cavity, paranasal sinuses, upper lip.*

*Drains by valveless, facial vein into Sup. Ophth. Vein  
this area*

***INFECTION*** of



***Causes SEPTIC THROMBOSIS*** of CS



# **Harris & Rhoton- divided CS into 4 compartments, with relation to ICA**

## **ANTEROINFERIOR COMP.**

*-Smallest, behind sup. Orbital fissure.*

*-invaded by orbital tumor.*

***-surgical appro. – Anterolaterally, by drilling ACP/ trans-sylv.***

## **LATERAL COMP.**

*-consist of lat. Dural wall, 3<sup>rd</sup>, 4<sup>th</sup>, V1 N.*

*-filled/ displaced by 5<sup>th</sup> N. tumor, ICA aneurysm.*

***-Surgical appro. – posterolater./ subtemporal***

## **MEDIAL COMP.**

*-medial dural wall, lat. surface of pituitary.*

*-Invaded by pituitary tumor.*

***-Surgical appro. 1)superiorly- roof, medial to 3<sup>rd</sup> N. 2)inferiorly- sphenoid sinus / sella turcica***

***POSTEROSUPERIOR COMP. – located post. to ICA bend.***

*-Filled by sphenopetroclival meningioma/ clival chordoma.*

***-Surgical appro.–extradural, subtemp./Kawase***

## NEURAL RELATIONSHIP

**IIIrd N.-** Runs ant.- lat. & inferiorly.  
-enters CS through ROOF, medial to ant. Petroclinoid lig. → Runs in lateral wall of CS, inferolateral to ACP → **During drilling of ACP 3<sup>rd</sup> N. is vulnerable to injury.**

**IVth N.-** enters ROOF CS posterolateral to IIIrd N. & inferomedial to free edge of tent → Runs in lateral wall of CS anteroinferiorly → enters in SOF

**Vth N.-** enters through Meckel's cave.

**V1** passes through lateral wall of CS →

Runs anteriorly & upwards, enters SOF

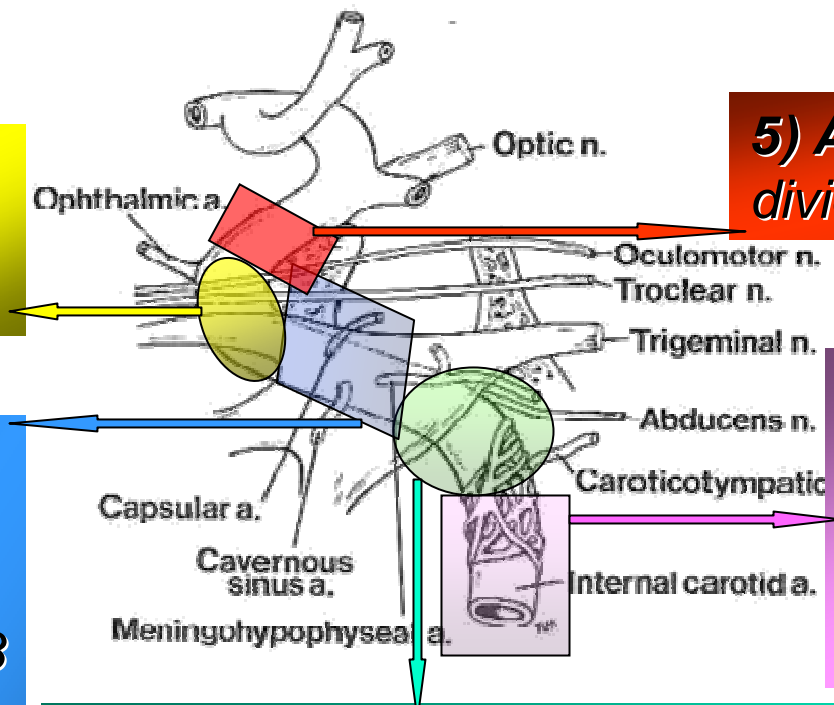
**V2** passes for a short distance in lateral wall of CS → enters in f. rotundum

**VIth N.-** enters to CS through Dorello's canal → runs anteriorly, inferolateral to ICA in the substance of CS → splits in rootlets → enters in SOF

**Sympathetic fiber bundles**, with carotid a. emerges from the foramen lacerum.

Some of the fibers join the VIth nerve before ultimately being distributed to the V1 division → sends symp. fibers to pupillodilator → long ciliary nerves & ciliary ganglion → **HORNER'S SYN**

# ARTERIAL RELATIONSHIP



**4) ANT. BEND** – in 8% cases give rise to **Ophthalmic A.**

**5) ANT. VERTICAL SEG.** - divides into **PCA, MCA, ACA**

**3) HORIZONTAL SEG.** – 2 arteries, -  
**i) Inf. Cavernous sinus A.** - middle 1/3 84%, source of CCF/ bleeding, aneurysm.  
**ii) McConnell capsular A.** - arises medial aspect, 4-28%, supply capsule of pituitary

**1) POST. VERTICAL SEGMENT** – fixed by lateral fibrous ring. – Doesn't give-off branch.

**2) POST. BEND** – related to age of pt. & arteriosclerosis  
 - Middle 1/3, 80- 88%, arises **Meningohypophyseal trunk**, -give rise to 3 branches, **i) tentorial A. of Bernasconi & Cassinari**– courses posterolaterally, supply tent./ tentorial meningioma. **ii) Inf. Hypophyseal A.**– courses anteromedially, supply post. Pituitary, anastomose to opp. side. **iii) Dorsal meningeal A.**– courses posteroinferomedially, supply dura along upper clivus.

# ***TRIANGULAR ENTRY CORRIDORS TO CAVERNOUS SINUS***

***-Divided into 3 subregions***

## ***A) PARASELLAR REGION –***

- 1) Anteromedial*
- 2) Paramedial*
- 3) Oculomotor or Superior*
- 4) Parkinson's or lateral*

## ***B) PARACLIVAL REGION –***

- 5) Posteroinferior*
- 6) Premeatal*
- 7) Postmeatal*

## ***C) MIDDLE CRAN. FOSSA REGION –***

- 8) Mullan's or Anterolateral*
- 9) Far Lateral*
- 10) Glasscock's or Posterolateral*
- 11) Kawase's or Posteromedial*

# ***PARASELLAR REGOIN TRIANGULAR CORRIDORS :***

## ***1) ANTEROMEDIAL TRIANGLE:***

*-medially-* lat. Border of opt. N. sheath, *laterally-* medial wall of SOF, *posteriorly-* dural ring of ICA

***-Exposes Ant. Bend of ICA.***

## ***2) PARAMEDIAL TRIANGLE:***

*-medially-* post. margin of subclinoid ICA, *laterally-* lat. Wall of intradural ICA, *posteriorly-* PCP & 3<sup>rd</sup> N. trigone.

***-Exposes distal horizontal seg. ICA***

## ***3) OCULOMOTOR OR SUP. TRIANGLE:***

*-medially-* 3<sup>rd</sup> N., *laterally-* 4<sup>th</sup> N., *posteriorly-* incisural edge.

***-Exposes Post. Bend ICA, meningo hyp. trunk***

## ***4) PARKINSON'S OR LATERAL TRIANGLE:***

*-medially-* 4<sup>th</sup> N., *laterally-* V1 N., *posteriorly-* incisural edge

***-Exposes Post. Bend & Horiz. Seg. of ICA, Dorello's canal***

# ***MIDDLE CRANIAL FOSSA REGION TRIANGULAR CORRIDORS:***

## ***10) Mullan's or anterolateral triangle :***

***-medially- V1 N., laterally- V2 N., anteriorly- line from SOF to ROT. fora.***

***-Exposes sup. Ophth. Vein, T/T CCF***

## ***11) Lateral triangle :***

***-anteriorly- V2 N., posteriorly- V3 N., laterally- line from ROT.fora. to FO.***

***-used to explore sphenoid sinus***

## ***5) Glasscock's or Posterolateral Triangle :***

***-anteriorly- V3 N., medially- greater superficial petrosal N., laterally- line joining from foramen spinosum to foramen Ovale.***

***-Exposes intrapetrous ICA/ for proximal anast. in cavernous- carotid bypass***

## **6) Kawase's or Posteromedial Triangle :**

***-medially-*** line joining gasserian ganglion to petrous apex or superior petrosal sinus,

***-posteriorly-*** line joining petrous apex or superior petrosal sinus to cochlea,

***-laterally-*** line joining gasserian ganglion to cochlea, deeply passes ICA to this line.

***-Petrous bone of this part has no neural or vascular structure/  
can be drilled out to expose post. Fossa, in petroclival  
meningioma/ chordoma***



# ***PARACLIVAL REGION TRIANGULAR CORRIDORS***

## ***(8) Premeatal triangle:***

- Anteromedially-*** line joining post. bend of ICA to median lip of IAM.
- Posteriorly-*** line joining geniculate ganglion to IAM.
- Laterally-*** line joining post. bend of ICA to geniculate ganglion.
- Cochlea is located in this triangle***

## ***(9) Postmeatal triangle:***

***Anteromedially-*** line joining lat. lip of IAM to geniculate ganglion.

***Posterolaterally-*** geniculate ganglion to post. End of arcuate eminence.

***Postermadially-*** post. End of AE to lat. Lip of IAM.

## ***(7) Posteroinferior Triangle :***

***Medially – Posterior Clinoid process***

***Laterally – Porous trigeminus***

***Inferiorly – entrance to Dorello's canal***

***Incision in this area expose (Gruber's) petrosphenoid lig. / entrance to Dorello'S canal.***

## ***CLINICAL PRESENTATION***

### ***Symptoms:***

- 1) visual deterioration- blurring, dimming/ field defect***
- 2) diplopia***
- 3) lid droop- LPS– 3<sup>rd</sup> N. palsy/ Muller's muscle– Symp.N***
- 4) Proptosis***
- 5) facial pain/ numbness- V1/ V2 distribution.***
- 6) headache/ vomiting***
- 7) lid swelling/ nonirritant redness of eye***

### ***Signs:***

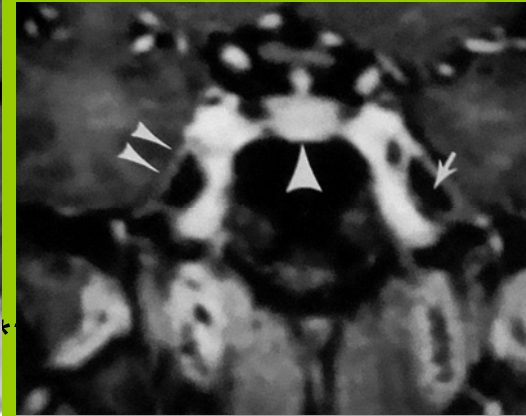
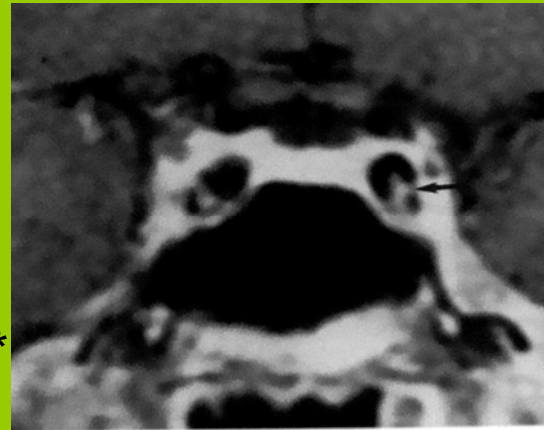
- 1) visual- prechiasmal lesion- U/L blindness  
postchiasmal lesion- field defect***
- 2) squint***
- 3) Horner's syn./ sensory loss over- cornea/ face***

## ***LESION OF CAVERNOUS SINUS***

- ***Tumors – meningioma***
  - *pituitary adenoma*
  - *schwannoma*
  - *metastatic lesion*
  - *chondromas/ chondrosarcoma/ lymphoma/ hemangiomas/ hemangiopericytoma/ epidermoid/ teratoma*
- ***Large vessels abnormality- dolichoectesia/ aneurysm***
- ***Abnormal vascular connection- CCF***
- ***Inflammatory lesion- histiocytosis/ sarcoidosis***
  - *cavernous sinus thrombosis- bact./ fungal*
  - *Tosola- Hunt syndrome*

# ***PRESURGICAL EVALUATION OF CAVERNOUS SINUS***

- 1) MRI
- 2) MRA & MRV
- 3) DSA



\*\*\*\*\*

## ***MRI :***

- It is **investigation of choice** for cavernous sinus lesion.

-Thin section **CORONAL contrast enhancing T-1 W** image is best to identify CS.

- *CS is seen just lateral to pituitary gland, enhance brightly.*

- *Tubular flow voids seen within CS is of ICA*

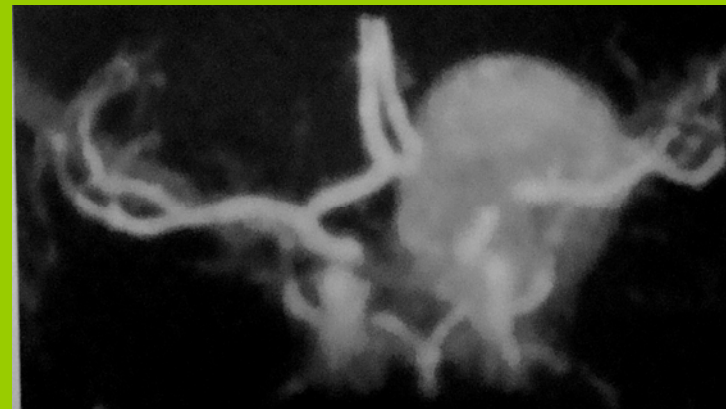
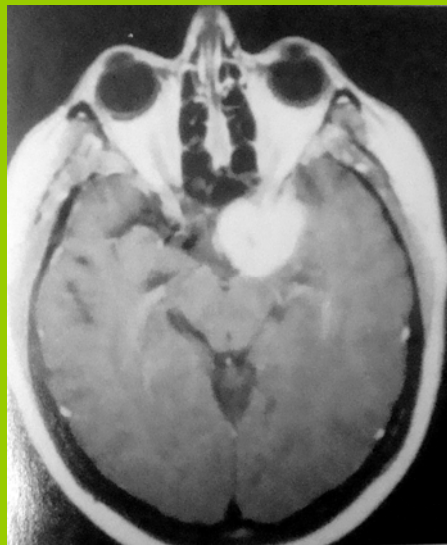
- thin section **CORONAL T-2 W** image, shows tubular flow voids of ICA, Meckel's cave is hyperintense.

- Axial MR imaging of CS shows anteroposterior relationships of cavernous sinus.
- Axial section shows anterosuperior relation of CS to ACP, optic canal & inferior relation to SOF






## ***- MRA & MRV***

- MRA reveals complex 3D TOF evaluation of tortuous ICA.***
- Displacement, elongation, & encasement of cerebral vasculature, helps in presurgical planning.***
- Can predict the presence of cavernous aneurysms.***
- Major limitation of MRA, is the demonstration of tumor vascularisation.***
- MRA overestimates the degree of vessel stenosis compared to DSA***



# ***DSA***

- ***Cross-compression***  ***about the integrity of the intracranial circulation***
- ***ICA is at excess risk ( meningioma, schwannoma)***  
  
***assessment of collateral circulation***  
  
***balloon test occlusion.***
- ***To know vascularity of tumor for presurgical embolization planning***
- ***To know size, site of origin of aneurysm/ CCF, for treatment planning.***



# ***ANESTHETIC CONSIDERATION & INTRAOPERATIVE MONITORING***

- ***AIM*** : to provide increased relaxation to neural tissue & protection against ischemia.
- *To minimize brain retraction with maximum exposure*, following steps are recommended –
  - \* *Osmotic diuretic agents – 20% Mannitol* infusion as 5ml/ kg along with *furosemide* 20 -40 mg at the time of skin incision.
  - \* Maintenance of *END TIDAL CO2 pressure between 25-30 mm Hg*.
  - \*CSF drainage- *ventricular drain (frontal)/ lumbar drain*.

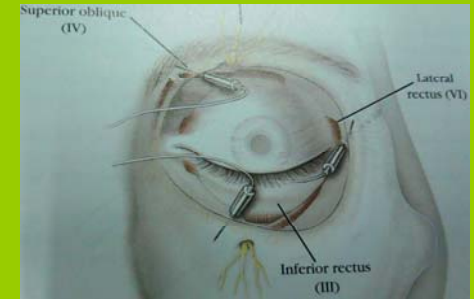
# ***Intraoperative Neurophysiological monitoring***

\* ***SSEP & EEG*** is recommended in cases where temporary occlusion of carotid artery is required.

\* ***EOM electrode*** implanted to monitor 3<sup>rd</sup>, 4<sup>th</sup>, 6<sup>th</sup> N.



avoid unwanted nerve handling.



\* Before planned ***ICA occlusion***, ***PROPAFOL*** is given to point of ***EEG Burst Suppression***.

\* ***Flow probe***, is directly applied to ***PIAL surface*** of brain, to measure blood flow. Blood flow drop ***below 30ml/ 100gm/ min is unlikely to be tolerated.***

# ***SURGICAL APPROACHES***

## ***- General consideration***

- Anatomical knowledge with its application in MRI is helpful in surgical planning.
- Surgical strategy is dictated mainly by the specific entry corridors to CS.

- *Lesions of anteromedial region*



*Anteromedial & anterolateral Triangles*

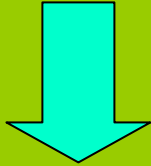
- *Lesions of anterolateral quadrant*



*Lateral & posterolateral Triangles*

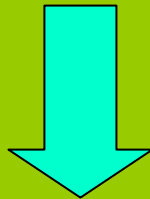


- *Lesions of posteromedial & anteromedial quadrant*



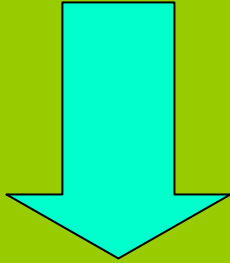
Requires intradural exposure  
& medial, superior, lateral  
triangles dissection

- *Lesions of posterolateral quadrant*



*Requires extradural exposure &  
far lateral & posterolateral dissection*

- *Lesions involving all quadrants of CS with extension into posterior fossa*



*Requires a combined approach with extradural & intradural exposure & anteromedial & Middle fossa transpetrosal approach*

# ***SURGICAL APPROACHES TO CAVERNOUS SINUS***

***FRONTOTEMPORAL  
EXTRADURAL &  
INTRADURAL  
APPROACHES***

***ANTEROLATERAL  
TEMPOROPOLAR  
TRANSCAVERNOUS  
APPROACHES***

***LATERAL  
APPROACH TO  
POSTERIOR  
CAVERNOUS SINUS  
REGION (Rhomboid  
Approach)***

# ***FRONTOTEMPORAL EXTRADURAL & INTRADURAL APPROACH***

- *Initially developed by DOLENC – as anteromedial transcavernous approach, for intracavernous aneurysm.*
- *UNDERWENT SEVERAL MODIFICATIONS.*
- ***INDICATION – Lesions confined to cavernous sinus/ with supratentorial extension.***
- ***ADVANTAGE - Can be combined with Middle fossa transpetrosal approach for excision of posterior extension of tumor.***

## **POSITIONING –**

- *On the 3- pin/ Horse shoe.*
- *Head is rotated to opp. Side about 30 degree.*
- *Vertex oriented slightly downward, malar eminence to be highest point of head.*
- **Called “HEAD HANGING” position**



# INCISION & FLAP ELEVATION

## **SINGLE LAYER TECHNIQUE:**

*Extradural bone removal is minimal.*

*-Limited inf. to sup. Viewing angle.*

*-**Incision**- ant. to tragus, at level of zygoma/ proceed sup./ frontotemporal*

*- Galea/ pericranium & temporalis muscle/ fascia elevated in single layer.*

## **HALF- &- HALF TECHNIQUE:**

*-For vascularized pericranial flap.*

*-**Incision**- same*

*- At sup. tem. line pericranium is incised.*

*Temporalis muscle/ fascia are elevated with scalp.*

## **TWO- LAYER TECHNIQUE:**

*- For vascularized pericranial flap.*

*-Maximum inf. to sup. Viewing angle*

*-**Incision**- same, with 1cm below tragus.*

*-Galea is reflected over temporalis fascia with incision in fat pad, to save frontalis N.*

*- Temporalis muscle is reflected inf. & post.ly*

# **(1) FRONTOTEMPORAL CRANIOTOMY**

**-2- 3 bur-hole.**

**-1st hole – keyhole area**

**-2<sup>nd</sup> hole-** below STL & post. Limit of exposed bone.

**3<sup>rd</sup> hole-** temporal base.

**-Frontal sinus is exposed then mucosa removal, packing of sinus with muscle/ fat, exteriorization.**

**-Exposes-** suprasellar, anteromedial, anterolateral, lateral & some posterolateral triangle.

## **(2) TRANSZYGOMATIC CRANIOTOMY**

- Periosteum of zygomatic process is separated & elevated.*
- Anterior cut in zygoma is made parallel to lateral orbital rim.***
- Posterior cut is made parallel to temporal squama through root of temporal zygomatic process.***



### **CARE OF TM JOINT DISRUPTION!!!**

- Exposure-*** increases inf. to superior. Exposure to posterolateral triangle improves.

### **(3) ORBITOZYGOMATIC CRANIOTOMY**

- Periorbital fascia is separated.*
- Approx.ly 1.5 cm orbital depth is separated from fascia.*
- 2 bur-holes are made- 1<sup>st</sup> at keyhole point & 2<sup>nd</sup> at 5 cm post. & inf. In temporal bone.*
- Frontotemporal bone is divided with B-1 up to sup. Orbital margin.*
- At supraorbital notch, B-1 is curved to save nerve.*
- Sup. to inferolateral orbital wall, & zygometico- maxillary process above suture is divided.*
- Post.ly zygomatic process is divided.*

## ***EXTRADURAL BONE REMOVAL***

- ***AIM: To improve exposure, mobility & transposition of neurovascular structures for wider corridors of access.***
  
- ***SPHENOID WING is drilled- out, under constant irrigation***  
  
***medially up to meningoorbital artery.***
  
- ***SUPERIOR ORBITAL FISSURE is drilled***  
  
***to expose approx. 10 cm of periobital fascia***

***-ANTERIOR CLINOID PROCESS is slowly drilled, till it becomes papery thin & should **never be removed in single piece.*****

***-If, there is **calcification of intraclinoidal dural folds**, it should be intermittently drilled & separated from dura, removed with biopsy forceps.***

***-Foramen rotundum is drilled to mobilize 5- 8 mm of V2 N., for exposure through anterolateral corridor.***

***-Foramen Ovale is drilled to mobilize V3 N. , for exposure through far lateral & posterolateral corridors.***

**- For INTRAPETROUS CAROTID ARTERY exposure:**

**1) Dura is elevated in posterolateral (Glasscock) triangle**

**2) MMA is coagulated & divided.**

**3) GSPN is identified in groove .**

**4) Below & parallel to GSPN lies  
ICA, If needed GSPN is divided.**

**5) Drilling is done post. To V3 N.  
& medial to foramen spinosum.**

**6) Danger of cochlear disruption.**

# ***INTRADURAL TRANSCAVERNOUS DISSECTION***

- ***Dura is opened either in curvilinear fashion or in inverted T- shaped in the direction of sylvian fissure.***

- ***Anterior 3-4 cm of sylvian fissure is opened.***

- ***anteromedial, paramedial, Oculomotor, Parkinson's triangle & anteromedial ,poseromedial***  
***Triangular corridors can be explored.***



# ***ANTEROLATERAL TEMPOROPOLAR TRANSCAVERNOUS APPROACH***

- ***HEAD POSITION-*** 30\* rotated to opp. Side, ***HEAD- HANGING***
- ***INCISION-*** Frontotemporal, starting below zygomatic process.
- ***Two- layered scalp flap is required.***
- ***CRANIOTOMY-*** Orbitozygomatic
  - ***Transzygomatic***
- ***Dura from temporal base & outer layer of CS dura is separated & reflected posteriorly.***

- ***L-shaped dural incision –***
  - 1)-***along sylvian fissure up to optic N. sheath.***
  - 2)- ***carried medially up to tuberculum sella.***
  
- ***Only 1-2 cm of sylvian fissure is opened.***
  
- ***Exposure: Medial, superior, anterolateral corridors.***
  
- ***Dural closure is difficult, near Optic N. sheath.***

# ***LATERAL APPROACH TO POSTERIOR CAVERNOUS SINUS REGION (RHOMBOID APPROACH)***

- ***HEAD POSITION-***                      90\*   /   60\*
- ***INCISION-***                      Question mark   /   Extended Frontotemporal
- ***CRANIOTOMY-***                      Temporal   /   Frontotemporal with generous extension to zygoma base.
- Middle fossa *dura* is elevated posteriorly & laterally over petrous ridge.
- Care of GSPN is taken, retraction causes facial palsy.

- *Bone to be drilled out in middle fossa is geometrically RHOMBOID SHAPE*

- 1) *Intersection of GSPN to V3.*
- 2) *Intersection of line projecting along the axis of GSPN to AE.*
- 3) *AE intersection with petrous ridge*
- 4) *Porous trigeminus.*

- *GSPN can be sectioned, to avoid VIIth N. retraction.*

- *Bone resection begins with exposure of Internal Auditory Canal.*
- *270\* ICA exposure by drilling.*
- ***Petrous ridge is drilled inferiorly up to INFERIOR PETROSAL SINUS.***
- ***SUPERIOR PETROSAL SINUS is clipped & divided after opening dura.***
- ***EXPOSURE:*** *posteromedial, posteroinferior corridors & petroclival area.*
- ***COMPLICATION:*** *hearing loss due to violation of cochlea or bony labyrinth.*

# ***TECHNICAL CONSIDERATION OF INTRACAVERNOSUS TUMOR RESECTION***

**- Well encapsulated & nonadherent tumors can be removed by:**

- 1) exposure of tumor capsule from surrounding tissue.**
- 2) debulking of tumor.**
- 3) sharp dissection of tumor capsule from surrounding tissue.**

**- Invasive & adherent tumors can be removed by:**

- 1) interruption of tumor blood supply from periphery of tumor.**
- 2) nerve become nonfunctional to be divided.**
- 3) invasion of intracavernous ICA requires bypass procedure.**

# ***TECHNICAL CONSIDERATION OF HEMOSTASIS***


- Bone bleeding can be controlled with wax & monopolar cautery.
- Bleeding from cavernous sinus is controlled by surgical & packing with cottonoids.
- ***Triangle*** / ***Area to be avoided for packing*** / ***structure***
  - 1) Anteromedial / lateral & medial / 2<sup>nd</sup> & 3<sup>rd</sup> N.
  - 2) Anterolateral / medial / 6<sup>th</sup> N.
  - 3) Far lateral / medial / 6<sup>th</sup> N.
  - 4) Paramedial / lateral / 3<sup>rd</sup> N.

# ***SURGICAL APPROACH TO CAVERNOUS SINUS MENINGIOMA***

## ***\*Treatment Options and Indications***

### ***-Three primary treatment options :***

- 1) Observation***
- 2) Microsurgical resection***
- 3) SRS (gamma knife and linear accelerator).***

***\* Observational treatment : asymptomatic or minimally symptomatic cavernous sinus meningioma  observation.***



## - ***STEREOTACTIC RADIOSURGERY :***

***Indication:*** Meningioma's < 3- 3.5 cm in size.

Minimally symptomatic, no cranial N. palsy.

***Contraindication:*** Meningioma **within 2 mm of Optic tract**, irradiation can cause blindness.

## - ***MICROSURGICAL RESECTION :***

***Aim :*** complete resection of meningioma.

- 1<sup>st</sup> surgery & RT causes extensive fibrosis & 2<sup>nd</sup> surgery causes much neurological deficit.

***Indication :***

- 1) Asymptomatic CS meningioma with increasing size in serial MRI.***
- 2) Irrespective of size, if tumor causing neurological deficit***  
***as***  
***hydrocephalus – brain stem compression***  
***visual deficit – optic tract compression***  
***squint/ diplopia – 3<sup>rd</sup>, 4<sup>th</sup>, 6<sup>th</sup> N.***  
***compression***

# ***SURGICAL APPROACHES FOR MENINGIOMA***

## ***CRANIOORBITOZYGOMATIC APP.***

***-Exposure-*** entire CS, proximal & distal ICA

***-Superior Approach-*** anterior, medial corridor meningioma.

***- Lateral Approach-*** lateral corridor meningioma

## ***EXTENDED MIDDLE FOSSA ZYGOMATIC APPROACH***

***-Exposure-*** post. CS, petrous apex & medial region.

# **SURGICAL APPROACH FOR INTRACAVERNOUS CAROTID ARTERY ANEURYSM**

- Patients having **neurological deficit** due to nerve compression

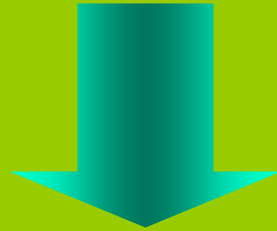


- **DSA & cross compression test** / balloon test occlusion (B. T. O.) are prerequisite surgery planning :

- ***Aneurysm of <2.5 cm & definable neck***  ***Clipping***

- ***Aneurysm of >2.5 cm & definable neck***  ***Clipping & aneurysmorrhaphy***

- *Patients having no nerve compression & only presented with SAH.*
- *DSA shows adequate size neck & suitable position of aneurysm.*



*can be treated by ENDOVASCULAR TECHNIQUE as BALLOON & GD coil embolization.*

***CONTRAINICATION- Large / Giant aneurysm, fusiform aneurysm, wide necked aneurysm.***

***Giant aneurysm***

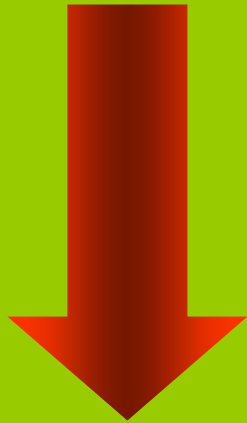
***Fusiform aneurysm***

***Poorly defined neck***

***Broad neck***



***Petrous –to-  
intracranial carotid  
bypass surgery***



***If cross compression test is sufficient, patient is old enough or not fit for extensive surgery ---- ICA ligation in neck***

# **Surgical Approaches for Intracavernous Aneurysm**

## ***DIRECT MICROSURGICAL APPROACH***

- ***Head Position*** – On 3- pin, 30- 40\*  
head rotation to opp side.
- ***Incision*** – Frontotemporal incision.
- ***Flap*** – two layered flap
- ***Craniotomy*** – Pterional
  - Transzygomatic
  - Orbitozygomatic

- ***Either ICA is exposed in neck for proximal control OR Intrapetrous ICA is drilled out for proximal control.***
- ***Dura is opened in inverted t-shaped fashion.***
- ***1-2 cm of sylvian fissure is opened.***
- ***Temporal lobe is retracted posteriorly.***
- ***CS is opened & nerves are mobilized.***
- ***Neck of aneurysm is defined & clipped.***
- ***Any bleeding from CS is controlled with surgical.***



# ***CAROTID- CAVERNOUS ARTERY BYPASS***

- ***Head Position- 30\* opp. Side rotation.***
- ***Incision- Extended Pterional incision.***
- ***Craniotomy- frontotemporal ,extended more towards temporal bone.***
- ***Dura is reflected from frontal & middle fossa .***
- ***Lesser wing of sphenoid, Superior orbital fissure ACP are drilled out.***
- ***Glasscock'S triangle is exposed, petrous bone drilled out for exposure of intrapetrous ICA to 270\*.***

- ***Proximally, petrous part of ICA is passed around by silk 0 suture for proximal control.***
- ***Subclinoidal ICA is trapped with temporary clip.***
- ***Heparinization is done.***
- ***SEPHANOUS VEIN graft is used.***
- ***Petrous ICA occlusion is done by cottonoid packing.***
- ***Proximally END TO END ANASTOMOSIS is done , 8.0/ 9.0 suture, interrupted.***

- ***Distally, END TO SIDE ANASTOMOSIS is done distal to ophthalmic artery.***
- ***Anastomosis is done under BARBITURATE COMA.***
- ***In post- op. HEPARIN is continued for 48 hrs.***

\*\*\*\*\*

# ***SURGICAL APPROACH TO CAVERNOUS- CAROTID FISTULA***

## ***Etiological classification:***

***1) Traumatic- 69- 75%, basilar skull fracture, M/F- 3:2***

***2) Spontaneous- 30- 25%, intracavernous aneurysm rupture.***

<b><i>TYPE</i></b>	<b><i>A</i></b>	<b><i>B</i></b>	<b><i>C</i></b>	<b><i>D</i></b>
<b><i>Feeders</i></b>	<b><i>ICA</i></b>	<b><i>Br. Of ICA</i></b>	<b><i>Br. of ECA</i></b>	<b><i>Br. of ICA/ ECA</i></b>
<b><i>% of CCFs</i></b>	<b><i>76- 84.6</i></b>	<b><i>0- 7 %</i></b>	<b><i>3- 10 %</i></b>	<b><i>8.9- 21 %</i></b>
<b><i>Flow</i></b>	<b><i>High</i></b>	<b><i>Low</i></b>	<b><i>Low</i></b>	<b><i>Low</i></b>
<b><i>Treatment</i></b>	<b><i>Balloon embolization/ SURGERY</i></b>	<b><i>Balloon embolization</i></b>	<b><i>Balloon embolization</i></b>	<b><i>Ocular &amp; carotid intermittent manual compression</i></b>

- ***Indication for surgical management:***

***1) fistular orifice too narrow for balloon penetration.***

***2) Venous compartment too small for balloon inflation.***

***3) Tortuous ICA or draining veins.***

***4) A complicated or extensive dural malformation.***

***5) Deflation of balloon.***

**- *Surgical technique:***

***Head position- 30\*, opp. Side***

***Incision- fronto- temporal***

***craniotomy- pterional***

***corridor- Parkinson's***

***-Supraclinoidal ICA temporary  
Clip & cervical ICA compression***

***-Packing with a piece of  
Crushed muscle with fibrin glue***

## ***SRS IN CCF TREATMENT***

***Indicated in spontaneous, indirect CCF , low flow type secondary to dural AVM. (type B, C, D)***

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## ***SURGICAL APPROACHES TO CS SCHWANNOMA'S***

<b><i>TUMOR LOCATION &amp; EXTEND</i></b>	<b><i>APPROACH</i></b>
<b><i>Confined to CS or minimally post. Fossa extent</i></b>	<b><i>Cranioorbital-zygomatic craniotomy</i></b>
<b><i>Middle fossa tumor with post. Fossa extension <b>above</b> level of IAC</i></b>	<b><i>Extended middle fossa approach</i></b>
<b><i>Middle fossa tumor with large post. Fossa extension <b>below</b> level of IAC</i></b>	<b><i>Petrosal craniotomy + EMF craniotomy</i></b>

# ***SURGICAL APPROACH TO PARASELLAR PITUITARY TUMOR***

## ***-Transnasal Transsphenoid approach:***

***# 20- 30 mm, far lateral sphenoid floor is removed.***

***# 30\* angled endoscope***

## ***-Transcranial approach:***

***# Frontotemporal craniotomy***

***# Bifrontal craniotomy***

***# Pterional craniotomy***



# Extradural transcavernous approach to cavernous sinus hemangiomas.

- Neurosurgery. 2007 Mar;60(3):483-8; discussion 488-9
- [Suri A](#), [Ahmad FU](#), [Mahapatra AK](#)
- **OBJECTIVE:** Cavernous sinus hemangiomas (CSHs) are uncommon lesions and comprise fewer than 1% of all parasellar masses. Because of their location, propensity for profuse bleeding during surgery, and relationship to complex neurovascular structures, they are notoriously difficult to excise.
- **CLINICAL PRESENTATION:** The authors describe their experience with **seven cases of CSHs**. Headache and visual impairment were the most common presenting complaints, followed by facial hypesthesia and diplopia.
- **INTERVENTION:** All CSHs were **treated by a purely extradural transcavernous approach**. The cranial nerves in the lateral wall of the cavernous sinus were exposed (Cranial Nerves III and IV, as well as V1, V2, and V3). The tumor was accessed through its maximum bulge through either the lateral or anterolateral triangle. **Transient ophthalmoparesis (complete resolution in 6-8 wk) was the most common surgical complication.**
- **CONCLUSION:** To our knowledge, we describe one of the largest series of pure extradural transcavernous approaches to CSHs. CSHs are uncommon but challenging cranial base lesions. The extradural transcavernous approach allows complete excision with minimal mortality or long-term morbidity

- **Intracranial Rosai-Dorfman disease in a child mimicking bilateral giant petroclival meningiomas: a case report and review of literature.**

- [Gupta DK](#), [Suri A](#), [Mahapatra AK](#), [Mehta VS](#), [Garg A](#), [Sarkar C](#), [Ahmad FU](#).

Childs Nerv Syst. 2006 Sep;22(9):1194-200. Epub 2006 Mar 16.

- **OBJECTIVES AND IMPORTANCE:** Rosai-Dorfman disease (RDD) is a rare but distinctive entity of unknown etiology; isolated intracranial RDD is uncommon. Of 37 reported intracranial RDD cases, only three were reported in children. **CLINICAL PRESENTATION:** We report an unusual case of a 15-year-old boy presenting with 4 months history of raised intracranial pressure with visual deterioration. Computed tomography and magnetic resonance imaging revealed bilateral petroclival enhancing lesions with cavernous sinus extension mimicking meningioma. However, histological examination was diagnostic of RDD. **INTERVENTION:** The patient underwent extended right-sided middle fossa approach and near-total tumor removal from petroclival region and cavernous sinus on both sides in two stages 6 weeks apart. **CONCLUSION:** Ours is the first case of **pediatric isolated intracranial RDD presenting with giant bilateral petroclival masses successfully managed with bilateral extended middle fossa approach in two stages**. An optimal treatment for RDD is not established, but complete surgical resection alone seems effective

## ***TAKE HOME MESSAGE***

- ***Proper knowledge of CS anatomy is very important.***
- ***Proper presurgical clinical & radiological assessment helps in surgical planning & avoid catastrophe.***
- ***For surgeons, cavernous sinus surgery requires proper training, experience & guidance by senior surgeons.***
- ***Craniotomy, exposure, laxed brain, brain retraction, drilling are important part of surgery to avoid post-op. neurological deficit.***

- **All tumors to be considered in relation of 11 triangular corridors, for surgical planning.**
- **3 types of approaches-**
  - 1) **Frontotemporal extradural & intradural**
  - 2) **Anteriolateral Temporopolar transcavernous**
  - 3) **Rhomboid approach.**
- **3 types of flap-**
  - 1) **single layer**
  - 2) **half & half layer**
  - 3) **Two-layer**
- **3 types of craniotomy-**
  - 1) **Frontotemporal**
  - 2) **Craniozygomatic**
  - 3) **Cranioorbito-zygomatic.**

**THANKS**