

# **POSTERIOR CIRCULATION ANEURYSMS**

# Introduction

- 15 % of all intracranial aneurysms
- Technically difficult to tackle
- Present in the fifth and sixth decades of life,
- Most often in females.
- Saccular, fusiform or dissecting.

- Saccular aneurysms of posterior circulation most often occur at the basilar apex(45-55%) origins of SCA, PICA and PICA-VA junction, PCA, lower third basilar artery, VBJ and AICA.

- Fusiform aneurysms of vertebrobasilar system occur with intracranial atherosclerosis
- Dissecting aneurysms 31% of the vertebral artery lesions ,found in young males
- Dolichoectatic aneurysms of vertebral and basilar arteries result from dissections that produce fusiform degeneration

# Anomalies associated with aneurysm

- Hypoplastic or fetal PCAs, persistent carotid-to-basilar anastomosis arteriovenous malformation in the occipital lobes or cerebellum
- Connective tissue disorders(e.g. Polycystic kidney disease, Marfan's syndrome, Ehlers-Danlos syndrome)

# Anatomy

Three vascular territories

Basilar apex –

- Basilar artery(BA) bifurcation,
- Posterior cerebral artery(PCA),
- Superior cerebellar artery(SCA),
- BA-SCA junction,
- Upper basilar artery.

# Anatomy

- **Basilar trunk -**
- Midbasilar artery,
- Anterior inferior cerebellar artery(AICA).
- **The vertebral trunk –**
- Vertebral artery(VA),
- Posterior inferior cerebellar artery(PICA),
- VA-PICA junction,
- Vertebro-basilar junction(VBJ).

# Clinical presentation

- Acute subarachnoid haemorrhage
- Intraventricular haemorrhage
- Obstructive hydrocephalus

# Clinical presentation

- Cranial nerve deficit
- Oculomotor paresis aneurysms of basilar apex, upper basilar artery and superior cerebellar artery
- Abducens dysfunction aneurysms of verteobasilar junction and lower basilar trunk
- VII and VIII cranial nerve involvement(AICA)
- IX,X,XI(PICA)
- XII nerve PICA and vertebral artery aneurysm.

- **Giant aneurysms** of the vertebrobasilar system present with mass effect on adjacent cranial nerves and brainstem
- **Dissecting aneurysms** SAH non-hemorrhagic infarction of thalamus, brainstem or cerebellum signs of cerebral thrombosis; oculomotor palsy Horner's syndrome

# Diagnostic studies

- **Computed tomography**
- **Magnetic Resonance Imaging**
- **Four-vessel digital subtraction angiography**

# Management Options

- Clipping
- Endovascular
- Bypass procedures
- Others

# Surgical indications

- Complex aneurysms
- Vasospasm of parent vessel
- Aberrant anatomy of vessels making
- Negotiations difficult
- Patients choice

# Basilar apex

Aneurysms	Trajectory	Approach
Basilar top	Anterosuperior	Subtemporal
PCA		Pterional transsylvian
SCA		Transsylvian
Upper basilar artery		Modified pterional transcavernous transsellar
		Middle subtemporal transtentorial
		Orbitozygomatic
		<b>Extended orbitozygomatic approach</b>

# Basilar trunk- lateral

Aneurysms	Trajectory	Approach
Midbasilar artery	Lateral	<b>Transpetrosal (Kawase)</b>
AICA		Transtemporal (Sekhar)
		Retrolabyrinthine transsigmoid
		<b>Combined supra- and infratentorial approach</b>
		Transoral transclival approach
		Transoral transclival with Le Fort I maxillotomy(
		Extended middle fossa approach

# Vertebral trunk

Aneurysms	Trajectory	Approach
VA,	Posteroinferior	Midline suboccipital
PICA,		Paramedian suboccipital
VBJ		<b>Far lateral approach</b>
		Extended far-lateral approach

# Subtemporal approach

- Supine position with head tilted.
- Temporal craniotomy
- Temporal lobe retracted upwards till cerebral peduncles
- Field centered on third nerve
- Temporal lobe resection indicated if required

# Advantages

- Proximal control is ease
- Excellent visualization and easy dissection of perforators
- Anteriorly and Posteriorly directed aneurysms can be tackled easily.
- Fenestrated clips can be placed well

# Disadvantages

- Field is narrow
- Access to contralateral P1 is difficult
- Temporal lobe damage
- Intraoperative bleeding is difficult to control
- III nerve palsy is very common

# Transylvian approach

- Pterional craniotomy
- OZ osteotomy to improve superior view
- Bone removal (if required)
  - sphenoid ridge
  - anterior clinoids
  - dorsum sellae
  - clivus
  - medial petrous apex

# Advantages

- Familiarity with approach
- Proximal control is straight forward
- Wide exposure is possible
- Both P1 can be exposed

# Disadvantages

- Exposure of posteriorly located perforators is difficult
- Distal clip blade is difficult to visualize
- Anteriorly or posteriorly directed aneurysms difficult to tackle

# Orbitozygomatic and Extended Orbitozygomatic approach

- Extends the pterional approach by removing the superior and lateral portions of the orbit
- Higher view of basilar apex above the posterior clinoid process.
- Inferior exposure by removing three intradural bony obstacles-the anterior clinoid process, the posterior clinoid process and the dorsum sellae.
- Drilling the clivus opens a window to the anterior surface of the basilar artery

# Transpetrosal approach

- Retrolabyrinthine, translabyrinthine and transcochlear
- Approach the basilar trunk from lateral side
- ENT surgeon's assistance is required

- Retrolabyrinthine exposure  
bone posterior to semicircular canals is removed.  
hearing is preserved
- Translabyrinthine exposure  
semicircular canals are removed  
hearing is sacrificed  
seventh nerve is preserved
- Transcochlear  
hearing and seventh nerve both are sacrificed  
maximum bone is removed

# Extended middle fossa approach

- Popularized by Kawase
- Temporal craniotomy
- Extradural mobilization of temporal lobe
- Anterior petrous apex drilling of KAWASE'S triangle
- Approach the aneurysm from superior and anterior trajectory
- Hearing preservation

# Far lateral approach

- Lateral suboccipital approach, extreme lateral approach, extreme lateral inferior transcondylar exposure(ELITE)
- Most common approach to aneurysms of the vertebral trunk

- Position  
lateral decubitus with neck flexion and rotation and ipsilateral neck flexion
- Hockey stick or S shaped incision
- Bone removed
  - paramedian suboccipital craniotomy
  - half to two third of condyle
  - posterior arch of C1
  - rim of foramen magnum

- Extended far lateral approach
- Superior occipital bone is removed
- Transverse- sigmoid junction is exposed
- CPA is entered

# Combined supra-infra tentorial app

Two maneuvers -

- Posterior mobilization of sigmoid sinus
- Division of tentorium
- Superior petrosal sinus divided
- Vein of Labbe preserved
- Minimal brain retraction

# Midline Suboccipital craniotomy

- Indications
  - I. bilateral vertebral aneurysm
  - II. distal PICA aneurysms
  - III. bypass procedures

# Alternative surgical techniques

- **Parent artery occlusion**
- **Wrapping** methyl methacrylate silicone, polyvinyl and temporalis fascia
  - to induce fibrosis in the wall of the aneurysm
- **Trapping of distal aneurysms** distal PICA aneurysms

# Ligation

- When both Pcom are large in size,
- When balloon occlusion suggests good collateral circulation
- Gradual compression can be used
- Vertebral artery tolerate ligation very well if opposite
- Vertebral is not aberrant.

# Cardiac bypass with hypothermic circulatory arrest

- Giant and complex posterior circulation aneurysms
- 24 degree Celsius core cooling, the brain will be protected for 1 hour of complete circulatory arrest.
- Associated with significant morbidity and mortality rates

# Endovascular management

- Basilar bifurcation
- Lower basilar trunk
- Vertebrobasilar junction
- Patients choice

- **Endovascular obliteration**
- **Detachable balloons** Silicone balloons filled with iso-osmolar contrast medium (Iohexol) solidification agent like HEMA, latex balloons filled with Iohexol or silicone
- **Detachable coils**
- Free pushable coils (Cook)
  - MDC – Mechanically Detachable Coils (Balt, France)
  - IDC – Interlocking Detachable Coils (Japan)
  - GDC – Guglielmi electrically Detachable Coils (USA)

## Factors that limit successful endovascular aneurysm occlusion

- dome-to-neck ratio less than 2 neck
- width greater than 4 mm,
- inadequate endovascular access,
- unstable intraluminal thrombus
- if any arterial branch is incorporated in neck
- Stents can be used for these aneurysm

- Thank you