POSTERIOR CIRCULATION ANEURYSMS

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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
• Occulomotor paresis  aneurysms of basilar apex, upper basilar artery and superior cerebellar artery
• Abducens dysfunction  aneurysms of vertebrobasilar 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; ocular motor 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

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## Basilar trunk- lateral

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### Vertebral trunk

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<td>PICA,</td>
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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 straightforward

• 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 conoyle
  • 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
- 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