ANTERIOR CIRCULATION ANEURYSMS AND SURGICAL CONSIDERATIONS

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INTRODUCTION

- Incidence of aneurysm difficult to estimate
- Prevalence 0.2-7.9 %
- Half of the aneurysms ruptures
- Incidence of aneurysmal rupture is 6-12 / 100,000

INTRODUCTION

- Overall mortality at 6 months: 40% - 50%
- 15% of patients expire before reaching the hospital
- 25% die within 24 hours
- Only one third of those who survive have functional independent lives.


- Rebleed has a catastrophic morbidity: 48% to 78%
- Treatment of a ruptured aneurysm: imperative.

ANTERIOR CIRCULATION ANEURYSMS

86.5%
- Acom (30%)
- Pcom (25%)
- MCA bifurcation (20%).
- ICA bifurcation (7.5%)
- Pericallosal /callosomarginal artery bifurcation (4%)
CLINICAL PRESENTATION

- Major rupture
  - SAH
  - ICH
  - IVH
  - Subdural blood

- Mass effect- cranial nerve palsy:
  - 3rd nerve in PCOM
  - Chiasmal syndrome - ophthalmic, Acom

- Cranial neuropathy- giant aneurysm compressing brainstem

- Endocrine disturbance: sellar and suprasellar
CLINICAL PRESENTATION

- Worst headache of life
- Meningeal irritation
- LOC at the ictus
- Seizures in acute phase
- Focal neurologic abnormalities (25%): hemiparesis, aphasia, hemineglect, cranial nerve palsies, memory loss
**CLINICAL PRESENTATION**

- Ocular haemorrhages (20-40%)
- Hypertension
- Temperature elevation
- Tachycardia
SAH WORK-UP : CT SCAN

- Sensitivity decreases with respect to increased time from ictus:
  - 95% within the first 48 hours
  - 80% at 72 hours
  - 50% at 1 week
- Intraparenchymal hemorrhage may occur with MCA and PCOM aneurysms
- Interhemispheric and intraventricular hemorrhages may occur with ACOM aneurysms
- Outcome is worse for patients with extensive clots in basal cisterns than for those with a thin diffuse hemorrhage
- Helps rule out HCP
- Falsely negative
  - Small hemorrhages
  - Severe anemia
ACA ANEURYSM

Anterior circulation aneurysm
ACOM ANEURYSM

Interhemispheric fissure bleed

Gyrus rectus bleed
DACANEURYSM

- Interhemispheric fissure bleed
MCA aneurysm

Sylvian fissure bleed
SAH WORK-UP : DSA

- **Gold standard**: 80-85% sensitivity
- **Surgical information:**
  - Cerebrovascular anatomy, aneurysm location & source of bleeding
  - Aneurysm size/shape/orientation of dome and neck
  - Relation to the parent/perforating arteries
- **If negative (10-20%)**: repeat test 3-4 weeks later
- **May be useful to evaluate for possible cerebral vasospasm**
- **3-D reconstruction**: invaluable-
  - dome-to-neck ratio
  - parent artery or branch orientation to neck
  - enhances surgical view for clip placement and vessel reconstruction
SAH WORK-UP: CTA

- Reported to detect aneurysms larger than 3 mm
- Sensitivity of 95% and 83% specificity.
- Provide sufficient anatomic detail especially relation to nearby bony structure
SAH WORK-UP: MRA

- Can detect aneurysms >3 mm with 86% sensitivity
- Useful
  - Monitoring the status of small, un ruptured aneurysms
  - Evaluate the degree of intramural thrombus in giant aneurysms
  - Screening high risk patients: including 1st degree relative of patients with IC aneurysm
- False +ve 16%
Un-ruptured aneurysms: why treatment

- Risk of SAH is 0.05-6% each year
- 50% rupture: fatal
- Increase in size >1 cm increases the risk 11 fold

TIMING OF SURGERY

- Anterior circulation: early surgery has good results

Haley EC jr et al the international cooperative study on the timing of aneurysm surgery; the north American experience.
Stroke 23:205-214;1992
ISAT trial (Lancet 2005;360:1267-75)

- Prospective, randomized, controlled trial
- N = 2143 (ruptured intracranial aneurysms)
- The safety of endovascular coiling compared with clipping
- Mortality or disability was 30.6% vs 23.7% in surgical and endovascular group at one year (p=0.0019)
  - survival free of disability at 1 year is significantly better with coiling
- Relative and absolute risk reduction in dependency or death is 22.6% vs 6.9% in surgical and endovascular group
  - coiling is more likely to result in independent survival at 1 year than clipping; the benefit continues for at least 7 years
- Risk of rebleed was higher in endovascular group at one year
SURGICAL APPROACHES (ACA AND ACOM)

- Pterional craniotomy
  - usual approach

- Subfrontal approach
  - useful for superiorly pointing aneurysm when there is a large amount of frontal blood clot

- Anterior interhemispheric approach
  - contraindicated for anteriorly pointing aneurysms as the dome is approached first

- Trancallosal approach
PTERIONAL CRANIOTOMY (GOLD STANDARD)

Disadvantages:
- Temporalsis muscle wasting
- Significant retraction on frontal lobe
- Need to open the sylvian fissure, which may be difficult in some case (Fischer grade III & IV)
CHOICE OF SIDE OF THE CRANIOTOMY

A right Pterional craniotomy is used with the following **exceptions**:

- Large ACom aneurysm pointing to the right
- Dominant left A1 feeder to aneurysm (with no filling from the right A1)
- Additional left sided aneurysm
OPERATIVE APPROACH (DACA)

- Right anterior frontal Parasaggital craniotomy for the interhemispheric approach
OPERATIVE APPROACH (MCA)

Lateral trans-sylvian approach
- For the unruptured and uncomplicated MCA bifurcation aneurysm
- Exposes the dome first

Medial trans-sylvian approach
- For patients with short M1 segment, aneurysm arises from the proximal M1 trunk or have a complicated configuration with increased risk of rupture

Superior temporal Gyrus approach
- Advocated by Heros;
- For aneurysms A/W ICH
- The aneurysm is exposed through the hematoma cavity in the sup temporal gyrus
intracavernous and paraclinoid aneurysm

3 types:
- Cavernous segment
- Clinoidal segment
- Ophthalmic segment

- Female : male = 9:1
- 5-6 th decade
- incidental lesions/
  mass effect
- multiplicity
CAVERNOUS SEGMENT ANEURYSM:

- Most clinically significant aneurysms arise from the horizontal segment and project forward and laterally toward the SOF below the ACP
- cavernous sinus syndrome
- Life threatening risks are rare
CLINOIDAL SEGMENT ANEURYSM:

Anterolateral variant (can resemble opthalmic artery aneurysm):
- erode ACP
- Monocular visual loss
- Large ones can compress optic chiasm

Medial variant (can resemble superior Hypophyseal artery aneurysm):
- Enlargement into the pituitary fossa Hypopituitarism, may simulate Pituitary apoplexy, epistaxis.
CLINOIDAL SEGMENT DIFFERENTIAL DIAGNOSIS

Anterolateral variant

Projects dorsal and lateral vs. dorsomedial
Projection of the ophthalmic aneurysm

Origination proximal to the take off of the ophthalmic artery

Angiographic waist marking the penetration dura

Double density

Medial variant

Narrow neck because of COM Vs wide neck.
**OPHTALMIC SEGMENT ANEURYSM:**

Ophthalmic artery aneurysm
- Project dorsally compressing the Optic nerve
- **Monocular nasal field defect** is produced due to superolateral compression of ON against falciform ligament

Superior Hypophyseal artery aneurysm
- Arise from the inferomedial surface, burrow inferiorly below the diaphragm sella, expanding the carotid cave k/a parasellar variant
- Suprasellar variant has secondary suprasellar extension

Dorsal variant
- Ophthalmic segment aneurysm
OPHTHALMIC ARTERY ANEURYSM:

Arise dorsal to the ICA distal to Ophthalmic artery
No bony erosion as arise distal to ACP.

Produce hemorrhage in the chiasmatic & Parasellar cistern.
Occasionally hematoma in the orbitofrontal Gyrus.
SUPERIOR HYPOPHYSEAL ARTERY ANEURYSM:

They arise below the plane of the ACP. As the lesion expands and fills the suprasellar space, it may venture across the midline.
OPERATIVE TECHNIQUES

- Proximal control is obtained at the cervical ICA before craniotomy for the giant or complicated aneurysms or for ruptured clinoid segment lesions.
COMPLICATIONS OF PARAACLINOID ANEURYSM SURGERY

- Delayed ICA stenosis or thrombosis
- Visual deterioration
- III, IV, VI and miosis
- CSF rhinorrhea
**PCOM aneurysm**

- 50% of the ICA aneurysm
- Females
- SAH with a lateral suprasellar and ambient cistern pattern
- Intraparenchymal haemorrhage into the uncus of the temporal lobe, intraventricular haemorrhage into the temporal horn or haemorrhage into the subdural space can also occur
- Non pupil sparing occulomotor palsy
ICA BIFURCATION ANEURYSM

- SAH
  - may present with intraparenchymal haemorrhage into the basal ganglia simulating the hypertensive bleed
  - may enlarge to giant size and compress the optic apparatus
THANK YOU