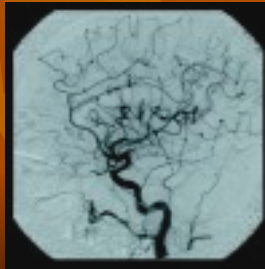


TREATMENT OF INTRACRANIAL ANEURYSMS



Introduction

- Incidence of aneurysm difficult to estimate
- Prevalence 0.2-7.9 %
- Half the aneurysms ruptures
- 2% present during childhood

Etiology

- Congenital
- Atherosclerotic/ hypertensive
- Embolic
- Infectious
- Traumatic
- Associated with other conditions

Presentation

- Major rupture
 - SAH
 - IVH
 - Subdural blood
- Mass effect
- Cranial neuropathy
- Endocrine disturbance

Presentation

- Minor hemorrhage/sentinel hemorrhage
- Small infarcts
- Seizures
- Headache
- Incidentally discovered

Factors deciding treatment

- Mode of presentation
 - Ruptured aneurysm
 - Un ruptured aneurysm
- Patients related factors
 - General condition
 - Medical co morbidities
- Aneurysm related factors
 - Location, anatomy, size
- Availability of expertise
 - Surgical
 - endovascular

Un-ruptured aneurysms:

Why to treat these aneurysms:

1. Risk of SAH is 0.05-6 % each year.
2. Around 50 % of these ruptures are fatal
3. Increase in size >1 cm increases the risk 11 fold

(ISUIA trial. N Engl J Med 1998;339:1725-33)

Risks factors for SAH

- Increased aneurysm size on serial imaging
- Posterior circulation aneurysms
- Previous SAH from another aneurysm
- Symptomatic aneurysms
- Females
- Cigarette smoking
- Binge alcohol drinking

Which un ruptured aneurysm to be treated?

- Symptomatic aneurysm
- SAH from another aneurysm
- Aneurysm > 10 mm
- Aneurysm between 6-9 mm in middle and young age group
- If any aneurysm increases on serial angiograms

Efficacy and risk factors of surgery

- More than 90% complete occlusion rate
- Mortality 0-3% in various series
- Morbidity 2-11% quoted in large studies
- Risk of surgery exceeds the 7.5 year risk of bleed in those aneurysm which are <10mm

Factors affecting surgical outcome

- Aneurysm related factors
 - Aneurysm size (>2.5).
 - Location (A comm, ICA bifurcation).
 - Orientation
- Patient related factors
 - Age
 - Ischemic cerebrovascular diseases
 - Diabetes mellitus

RUPTURED ANEURYSMS

- Sixty percent of patients either die or disabled.
- 20-30% rebleed in 30 days.
- 4% rebleed rate on day 1.
- more than 70% who rebleed, die.
- Aneurysm occlusion either surgical or endovascular is the only answer.

Treatment

- Resuscitation after SAH
- General medical treatment
 - Bed rest, analgesia, catheterization, stool softeners
 - Antiepileptic, steroids, CCB, antiemetics, sedation
 - Management of fluids and electrolyte imbalance
- Definitive management

Options for definitive treatment

- Surgery.
 - Simple Clipping
 - Wrapping
 - Parent vessel occlusion
 - Revascularization procedures
- Endovascular methods.
 - Destructive procedures
 - Reconstructive procedures
- Endoscopy
- Conservative

- The ideal treatment for aneurysms with good grade SAH (gr 1 and gr 2) is surgical clipping.
- However depending on the availability of expertise endovascular methods can be equally good.

Exclusive Indications for surgery

- SAH with intracerebral hematoma
- Presence of hydrocephalus
- Signs of raised IC
- Other conditions in which endovascular treatment is contraindicated

Timing of surgery:

- Anterior circulation: early surgery has good results compared to late
- Posterior circulations:
 - Easy aneurysms: early surgery
 - Difficult aneurysms : after two weeks

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

Early surgery

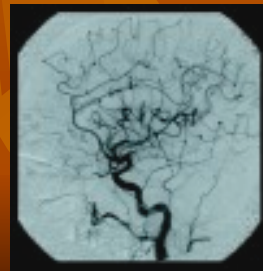
- Virtually eliminates re-bleed
- Facilitates treatment of vasospasm
- Allows removal of vasospasmogenic material
- Though operative mortality higher, but overall outcome is better
- Factors favoring early surgery:
 - Good medical condition of patient
 - Good neurologic condition
 - Large clot, blood
 - Early rebleed, multiple episodes
 - Imminent rebleed signs

Disadvantages

- Inflammation and brain edema causes more difficult and traumatic retraction
- Acute clot makes dissection difficult
- Risk of intraoperative rupture is high
- Vessel injury may aggravate vasospasm
- Factors favoring late surgery:
 - Poor medical neurological condition
 - Difficult aneurysms
 - Significant edema on CT
 - Active vasospasm

Goals of aneurysm treatment

- Complete, permanent and safe occlusion of aneurysm.
- Less morbidity and mortality.
- Good quality of life.



Technical considerations of aneurysm surgery

Intraoperative objectives

- prevent rupture
- Further enlargement
- Preserve normal vessels
- Minimize injury to the brain

Technical considerations of aneurysm surgery

- Clip too low- may occlude parent vessel
- Distal placement- aneurysmal rest
- Aneurysmal rest expand in future and may rebleed
- Surgical exposure:
 - avoid retraction
 - Brain relaxation- hyperventilation, CSF drainage, lumbar spinal drainage, cisternal drainage
 - drugs

Technical considerations of aneurysm surgery

- Cerebral protection:
 - Drugs that mitigate toxic effects of ischemia- CCB, barbiturates, mannitol
 - Reduce electrical activity- barbiturates, etomidate, isoflurane
 - By reducing maintenance energy- mild hypothermia (upto 33deg), mod hypothermia (32.5- 33), deep hypothermia (upto 18 deg), profound hypothermia (upto 10 deg)

Technical considerations of aneurysm surgery

- Intra operative aneurysm rupture- 18- 40% in most series
- Morbidity and mortality approach 30- 35%
- When can rupture occur:
 - Initial exposure- reduce Bp, place temporary clip if possible, lobectomy if necessary for exposure
 - Dissection of aneurysm- blunt or sharp tears- tamponade, temporary clip, . If extends to parent vessel micro sutures may be taken
 - Clip application- reapply clip or a second clip

Wrapping

- Generally never the goal of treatment
- Indications
 - On exposure aneurysm can not be clipped
 - Intraoperative ruptured aneurysm
- Substances used for wrapping
 - Muscle, muslin
 - Plastic resin or polymer,
 - Artificial glue and muscle, fascia or teflon

Parent vessel ligation:

- Indications:

- Large surgically difficult aneurysms
- Recurred after coiling
- Other unclipable aneurysms

- Prerequisite:

- Good collateral circulation on balloon occlusion test or cross compression test

Methods of parent vessel ligation

- Direct neck vessel ligation
- Gradual occlusion
 - Silverstone clamp

Revascularization procedures

- Indications:
 - All those patients planned for ligation of parent vessel ligation but poor collateral circulation

Outcome

- Results:
 - Good outcome in 80% of anterior circulation and 44% of posterior circulation
 - Graft patency rate of 86% at 18 mnths
- Complications
 - Acute graft occlusion
 - Aneurysm rupture due to hemodynamic changes
 - Ischemic deficits

Endovascular methods

- Exclusive Indications:
 - Poor grade SAH
 - Medical illness
 - Surgically difficult aneurysms like proximal ICA and basilar tops giant aneurysm
 - patients choice

Endovascular methods

- Destructive procedures
 - Balloon occlusion of parent vessel
- Reconstructive procedures
 - GDC technology
 - Balloon remodeling technique
 - Stent coil technique

Balloon occlusion

- Generally used for proximal ICA and vertebrbasilar aneurysms
- Advantages
 - Mass effect resolves
 - Cranial neuropathies are known to improve
- Disadvantages:
 - Recanalize, regrowth or rupture
 - Ischemic symptoms
 - Formation of de-novo aneurysms

GDC coils

- Platinum spiral coils with circular memory
- Fit snugly in the aneurysm and induce thrombosis
- Disadvantages:
 - Incomplete obliteration
 - Recanalization
 - Prolapse of coil and distal migration
 - Parent artery thrombosis

Balloon remodeling technique

- Introduced to overcome the problem of wide neck aneurysms
- Balloon is inflated in parent vessel against the neck and then coils are put in sac

Stent-coil technique

- Used in complex wide neck aneurysms
- Increases the density of coil packing

Limiting factors

- Dome to neck ratio < 2
- Neck width > 4 mm
- Inadequate endovascular access
- Unstable intraluminal thrombus
- Arterial branch incorporated in neck
- Middle cerebral artery aneurysms

ISAT trial (lancet 2005;360:1267-75)

- Randomized study of 2143 patients ruptured intracranial aneurysms
- Mortality or disability was 30.6 Vs 23.7 in surgical and endovascular gp at one year (p=0.0019)
- Relative and absolute risk reduction in dependency or death is 6.9 vs 22.6% in surgical and endovascular group.
- Risk of rebleed was higher in endovascular group at one year

Criticisms on ISAT trial

- Selection biases
 - premature analysis
 - Only 22.4 % were randomized
- Outcome assessment
 - MRs scale is used for assessment
- Lack of angiographic data after surgery
- Lack of long term follow up
- Surgical outcome
- Post procedural rebleed and outcome

Endoscopy

- Endoscope (fiberscope) to assist the microsurgical clipping of cerebral aneurysm- first reported by Fischer and Mustafa in 1994
- Rigid endoscope increasingly used during aneurysm surgery in which structures around the aneurysm can be detected with high quality imaging
- Endoscope - supportive role in planning surgical manoeuvres and verifying whether clipping has been performed correctly

Endoscopy

- Aneurysms of anterior circulation- particularly useful in those of the internal carotid and the anterior communicating arteries
- In many cases of these aneurysms the posterior communicating artery, choroidal artery or one of the distal cerebral arteries is hidden behind the aneurysm dome

Endoscopy

- Dome retraction is often required in order to see vascular structures with the microscope
- Endoscope with a 30 degrees view angle
- Concealed areas are identified without retraction, =prevents the possibility of the aneurysm being ruptured/ reduces the use of temporary clipping
- From its early use as a supportive measure that is sometimes useful in surgery for "easy" aneurysms, the endoscope has now become almost indispensable for the "difficult" aneurysms, including the large and giant ones before and after clipping

Special circumstances

- POOR GRADE SAH
 - Rapid resuscitation
 - Intracranial pressure monitoring
 - Early aneurysm occlusion
 - Prophylaxis against delayed ischemia

Advanced age

- Surgically treated patients do better than conservatively managed
- Treatment of unruptured aneurysm is beneficial if life expectancy is more than 13 years
- Treatment should not be denied only on the basis of age

PREGNANCY

- Investigated and treated as same.
- Pregnancy can be continued
- Temporary clips than hypotension during surgery
- Mannitol and hyperventilation to be curtailed
- LSCS is preferred in unruptured cases
- Craniotomy and LSCS performed together
- Anticonvulsants and CCB to be avoided.

Infective aneurysms

- Staph aureus is most common cause
- Course of IV antibiotics for 4-6 wks.
- Surgical excision of aneurysm followed by bypass, anastomosis, or ligation of vessel.

Giant aneurysms

- Aneurysms more than 25 mm
- Mortality quoted from 5-25%
- Good or excellent outcome in 70-80%

Treatment options

- Clipping (multiple clipping, fenestrated clips)
- Parent vessel ligation
- Revascularization with or without trapping
- Endovascular occlusion
- Aneurysmectomy
- Aneurysmorrhapy



Thank you