Rupture of cerebral aneurysms: Current Management and Prevention

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Objective

Background & brief literature review

Presentation of advanced endovascular and surgical strategies to successfully treat ruptured and unruptured aneurysms

Case illustrations
Disclosure

Nothing to disclose
What is a “cerebral aneurysm”?

- 49 yo F, Ruptured left ICA aneurysm
- H&H grade I
Intra-operative view
Seven days after surgery
Aneurysm Size

- Cooperative study of aneurysms and SAH (1966): Class ‘5’ aneurysms ≥ 2.5 cm, ‘unusually large’. 100% symptomatic, highest risk of bleeding
- Defined as ‘massive’ aneurysm ≥ 2.5 cm (1 inch) 1969
- First series of ‘giant’ aneurysms with management strategies reported (1969); AN ≥ 2.5 cm
- Dr. Drake’s series with 174 giant aneurysms (1979)

Aneurysm Size

Small & Giant
Aneurysm Size

Small & Giant
'Saccular'
(based on a ‘normal’ parent vessel)
‘Fusiform’
(no ‘normal’ parent vessel)

Epidemiology

Aneurysm prevalence

~ 3% [1% - 6%]
~ 9,000,000 in USA
~ 100,000 in OR

Giant aneurysms

~ ~ ~ 3% [3% - 13%]
~ ~ 270,000 in USA
~ ~ 3,000 in OR

Epidemiology

Projected number of strokes vs. aneurysm ruptures in US: 2002 - 2025

Source: Stroke, January 2004; J. P. Broderick, MD

Aneurysms: 30,000
Epidemiology

![Graph showing age distribution of patients]
Aneurysm locations

Brisman JL, Song JK, Newell DW. Cerebral aneurysms. NEJM 2006; 355:928-939
Natural history

1) Risk of SAH
2) Disabling mass effect
3) Ischemic stroke
4) HCP
5) Seizures
### Risk of Rupture (ISUIIA)

**5 year cumulative risk**

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Outcome after Rupture

- ~50% mortality
- ~25% disability
- ~25% good outcome
Treatment Goals

- Prevent Rupture
- Prevent Spasm
- Prevent Stroke
- Treat ICP
- Ensure Functional Survival
Treatment Option

• Endovascular (needle puncture in the groin)
• Surgery
Neuro-biplane Room
Vascular ORs

- Currently Smart OR design with DSA capability
- In August/September: Hybrid Angio-OR
Treatment Options (ISAT)

- Reduced morbidity/mortality at 1 year f/u:
  Coil (23.5%) vs clip (30.9%); p = 0.0001, n = 2118

- Reduced mortality at 5 year f/u:
  Coil (11%) versus clip (14%); p = 0.03, n=2087

Lancet. 2005 Sep 3-9;366(9488):809-17.
Clip vs Coil

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Lancet. 2005 Sep 3-9;366(9488):809-17.
Aneurysms, Case #1

Unruptured basilar apex aneurysm
Clinical summary

- 58 yo man
- Previous ‘TIA’ with LOC and confusion for days
- Complete recovery
- No neurological deficit
- History of hypertension
PCA?

DSA R VA
Fetal R PCA!

DSA R ICA
Short M1 segment
Options?

- No treatment
- Clip
- Coil (stent/coil)
Decision

- All options discussed
- Pt chose surgery
- Risk slightly higher?
- Protection from rupture likely better?
- Less to no follow-up required?
- Pt trusts surgeon!
Surgical Procedure (<3hrs)

- Supine
- Head turned 40 degrees
- Pteryoncal craniotomy
- Temporal craniectomy/cranioplasty
- Complete opening of arachnoid cisterns
- No uncus resection
- Pretemporal exposure
- Temporary occlusion x3 < 10 min
- Barbiturate burst suppression
R Pteryonal Approach
Outcome

- Patient did well
- No neurological deficit
- D/c home POD #3
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The endovascular alternative
Conclusions

- Surgery is still an option
- Permanent 3\textsuperscript{rd} nerve paresis possible
- \textbf{Surgical risk increases with size}
- RESPECT THE THALAMOPERFORATORS
- Surgery involves surgery with longer recovery
- Endovascular is done under conscious sedation
- Ev Tx requires multiple f/u angios
- \textbf{Choose endovascular if it is a good option}
Aneurysms, Case #2

Right ophthalmic giant aneurysm
Clinical background

- 63 yo F from Puerto Rico
- s/p left ICA sacrifice,
- tx of left giant carotid opthalmic aneurysm
- Now new right visual problems
- Pt is otherwise fairly healthy
DSA R ICA
Options

- No treatment
- Carotid sacrifice
- Direct clip reconstruction
- Stent/coil
- Bypass
Carotid ligation
Direct coiling
Waffle Cone Technique

Please, avoid the ‘leaky cherry’!
Surgical Options
Clipping of unruptured intracranial aneurysms (2 - 6 cm): Anterior circulation

No. of patients [%]

Patient age [years]

Direct clipping
Traditional Bypass - Interposition
So, what did we do?
Elana Technique
Elana ‘High flow bypass’
Elana ‘High flow bypass’
Outcome

- Patient had an excellent recovery
- D/c home after 1 week
Aneurysm, case #3

Rescue of the ‘lost’ Pipeline (PED)
Clinical summary

HPI: - 64 yo F from Puerto Rico
- s/p minor head injury

PMH: GERD

MEDS: Nexium, Ambien

PE: No neurological deficit
MRI -> 3 cm L IC cav mass
DX angio
Pipeline Embolization Device

- Braided mash cylinder
- 48 microfilaments
- Platinum and cobalt chromium strands
- Mounted on a flexible microwire
PED delivery & stacking,
How you do it
Neuron in horiz. Petrous ICA
First PED deployed
Significant change in flow
Looks good, but ...
Looks good, but ... 

...looks can be deceiving!!!
The ‘lost’ PED
Hours of frustrating fishing for the ‘lost’ PED go by...
Strategies attempted

1. Different catheters were used:

2. ‘C’ shaped, ‘J’ shaped, straight, angled, Enzo-modifiable tip

3. Different wires (stiff, soft)

4. Wrap-around technique

5. Grabbing the PED and retrieving into the aneurysm sack with different sized Alligators, Snares
NO SUCCESS

Re-access of the PED proves impossible

Think outside the box
Exploration of collaterals

acom

pcom
Options

1. Quit
2. Sacrifice without BTO (no change in SSEPs)
3. BTO the next day
4. Bypass
5. Trans pcom or acom rescue
6. No further treatment, see what happens
Rescue Intervention - Outline

1. One week later
2. Dual access (bilateral groin)
3. Transbasilar, transpcom wire
4. Transcarotid, intraaneurysmal snare
5. Capture
6. Re-access PED from proximal to distal
7. Finish the job
Step 1

- Trans-basilar, trans-pcom, retrograde catheterization of the ‘lost’ PED & aneurysm

- SL 10, synchro-2
Step 1

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Step 1

- Trans-basilar, trans-pcom, retrograde catheterization of the ‘lost’ PED & aneurysm
- SL 10, synchro-2

lateral
Step 1

- Trans-basilar, trans-pcom, retrograde catheterization of the ‘lost’ PED & aneurysm

- SL 10, synchro-2
Step 1

- Trans-basilar, trans-pcom, retrograde catheterization of the ‘lost’ PED & aneurysm
- SL 10, synchro-2
Step 1
Step 2

- Trans-carotid catheterization of the aneurysm
- Marksman, Snare
Step 3 – Capture

Contra-lateral oblique  lateral
Step 4 – Pull down

Contra-lateral oblique

ICA

lateral
Step 4

Pull down of transbasilar catheter
Step 5

Open snare, **advance transcarotid catheter** over transbasilar catheter through and beyond PED
Step 5

Trans-basilar wire, snare assisted rescue of the lost PED
Step 5

Trans-basilar wire, snare assisted rescue of the lost PED
Step 5

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Step 5

- Trans-basilar wire, snare assisted rescue of the lost PED
- Repositioning of the Marksman catheter
- Note tortuosity
Step 6 – More PEDs

Stasis – Half Moon Sign
Significant instant stenosis
Angioplasty
Salvage – More PEDs
PRE – POST

Lateral view
Outcome

- Patients headaches resolved
- Small amount of SAH (distal cave segment injury post angioplasty)
- Temporary hydrocephalus
- Temporary minor right sided weakness
- Pt is doing now well 2 wks after procedure
Giant aneurysms are a class of their own.

The treatment remains complex.

All options, surgical and endovascular need careful consideration.

All modalities, including the newest and latest technology, are available right here at Riverbend Hospital.
THANKS!!!