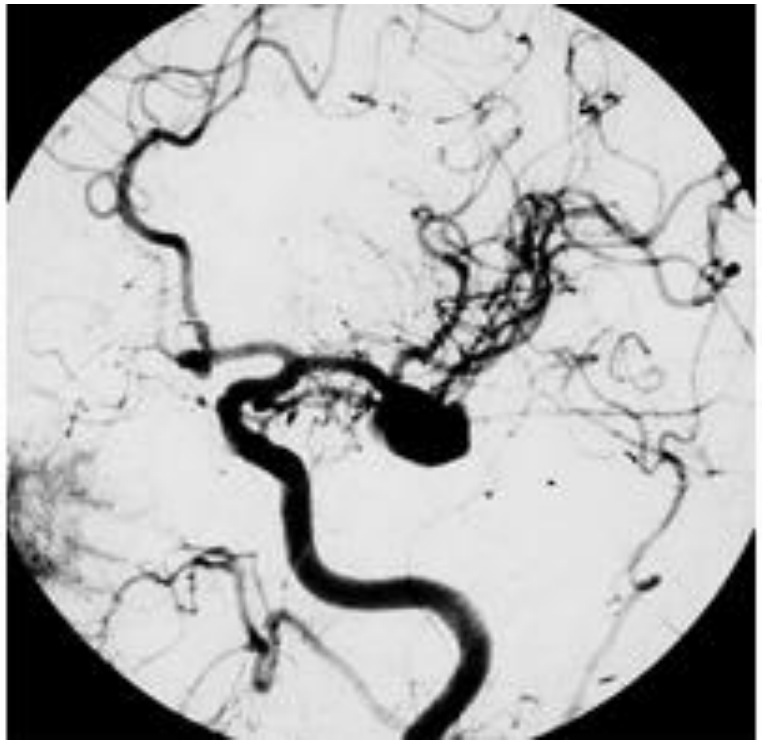
Cerebral Aneurysms

Dr. Nidal Abuhadrous MD, MRCS, ABHS(NS)
Consultant Neurosurgeon
Head of Neurosurgery – Nasser Medical Complex

Cerebral Aneurysms

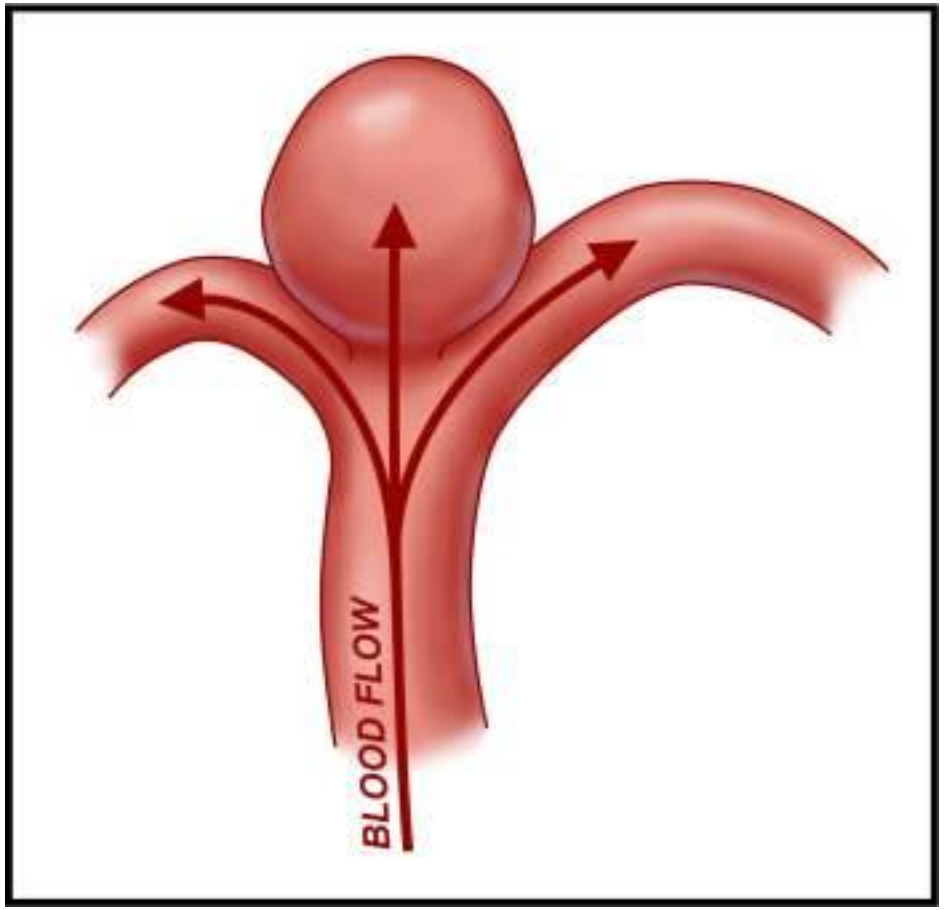


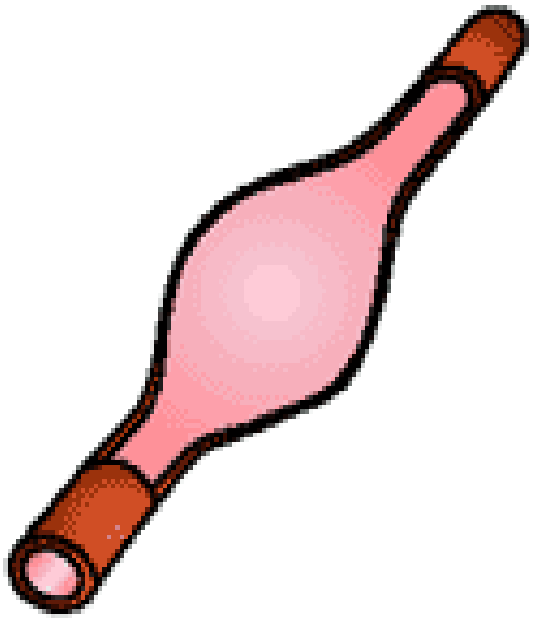


Cerebral Aneurysms

- Prevalence ≈ 5%
- Ruptured : Unruptured ratio is 1:1
- Etiology:
  - Congenital predisposition (medial gap, HTN)
  - Infection (Mycotic aneurysms)
  - Trauma (Traumatic aneurysms)
- Shape:
  - Saccular / berry
  - Fusiform

Saccular vs. Fusiform





Fusiform

Cerebral Aneurysms

Location:

- Saccular: Proximally on the major cerebral arteries at the branch points or curves (sites of maximum hemodynamic stress)
- Mycotic or traumatic: more peripherally
- Fusiform: more in the vertebrobasilar system

Cerebral Aneurysms

Location of saccular aneurysms:

- 85% Anterior circulation (carotid system)
  - Acom A 30%
  - Pcom A 25%
  - MCA 20%
- 15% Posterior circulation (vertebrobasilar system)
  - Basilar tip 10%
  - Vertebral (VA-PICA junction) 5%

Cerebral Aneurysms
Presentation

- Major rupture:
  - SAH (The most common presentation. Also ruptured aneurysm is the cause in 80% of spontaneous SAH)
  - ICH in 30%
  - IVH in 20%
  - SDH in 5%
- Other than major rupture:
  - Mass effect, seizures, small infarcts or TIA, minor hemorrhage, headache, incidental

Symptoms & signs of aneurysmal SAH

- Headache (sudden, severe, worst in life)
- Meningismus
- Coma
- Ocular hemorrhage

WFNS grading of SAH

WFNS grade	GCS score	Major focal deficit
0 (unruptured incidental aneurysm)		
1	15	-
2	13-14	-
3	13-14	+
4	7-12	+ or -
5	3--6	+ or -

Outcome of aneurysmal SAH

- 15% of patients die before reaching medical care
- 10% die within the first few days
- 30-day mortality rate 46%
- 30% of survivors have moderate to severe disability
- Rebleeding rate 20% in the first 2 weeks
- Vasospasm kills 7% of pts & causes severe deficit in another 7%

Investigations for Spontaneous SAH

- Which investigations to confirm SAH?
- Which investigations to differentiate the etiology of SAH?
- Which investigations used during management of SAH?

Investigations to confirm spontaneous SAH

- Computed Tomography (CT)
- Lumbar Puncture (LP)
- Magnetic Resonance Imaging (MRI)

Computed Tomography (CT)

- Good quality, non-contrast, thin cuts
- Sensitivity > 95% if within 48 hours
- Detect: SAH & its amount, HCP, ICH, SDH, infarction, aneurysm location
- Sensitivity decreases with increased time
- A contrast-enhanced CT scan may reveal an AVM

Fisher's CT Grades of SAH

Aim: To predict vasospasm

- GRADE 1: Normal Scan. No SAH.
- GRADE 2: Less than 1mm thickness of blood (Diffuse)
- GRADE 3: More than 1mm thickness of blood
- GRADE 4: IVH or ICH with diffuse or no SAH

Modified grading system of Fisher

Modified Fisher scale group	Blood on CT	Symptomatic vasospasm
	No SAH or IVH	
1	focal or diffuse thin SAH, no IVH	24%
2	focal or diffuse thin SAH, with IVH	33%
3	focal or diffuse thick SAH, no IVH	33%
4	focal or diffuse thick SAH, with IVH	40%

Grade 1 SAH

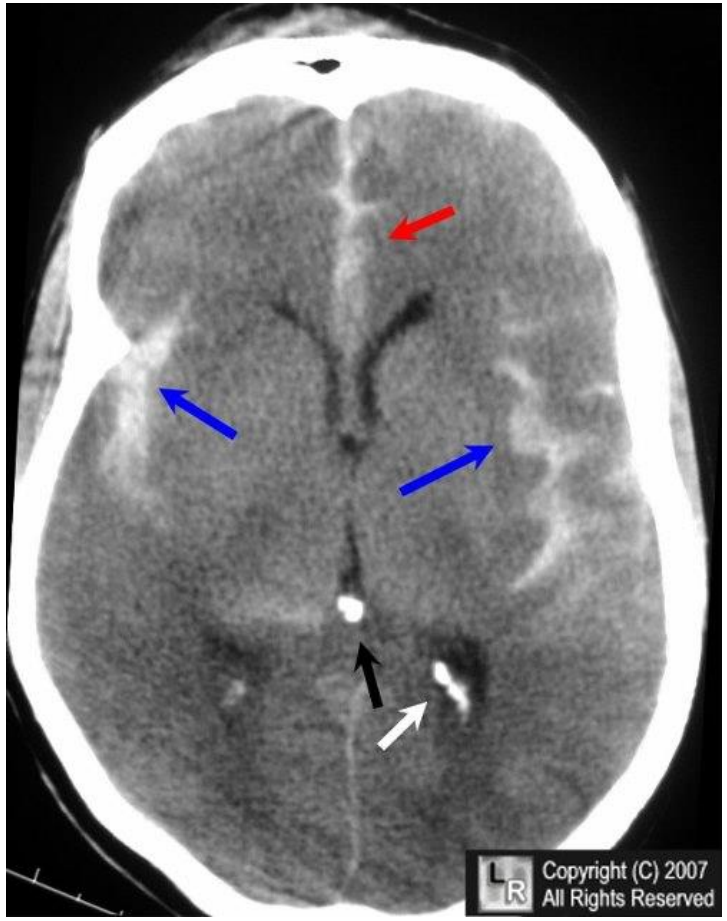




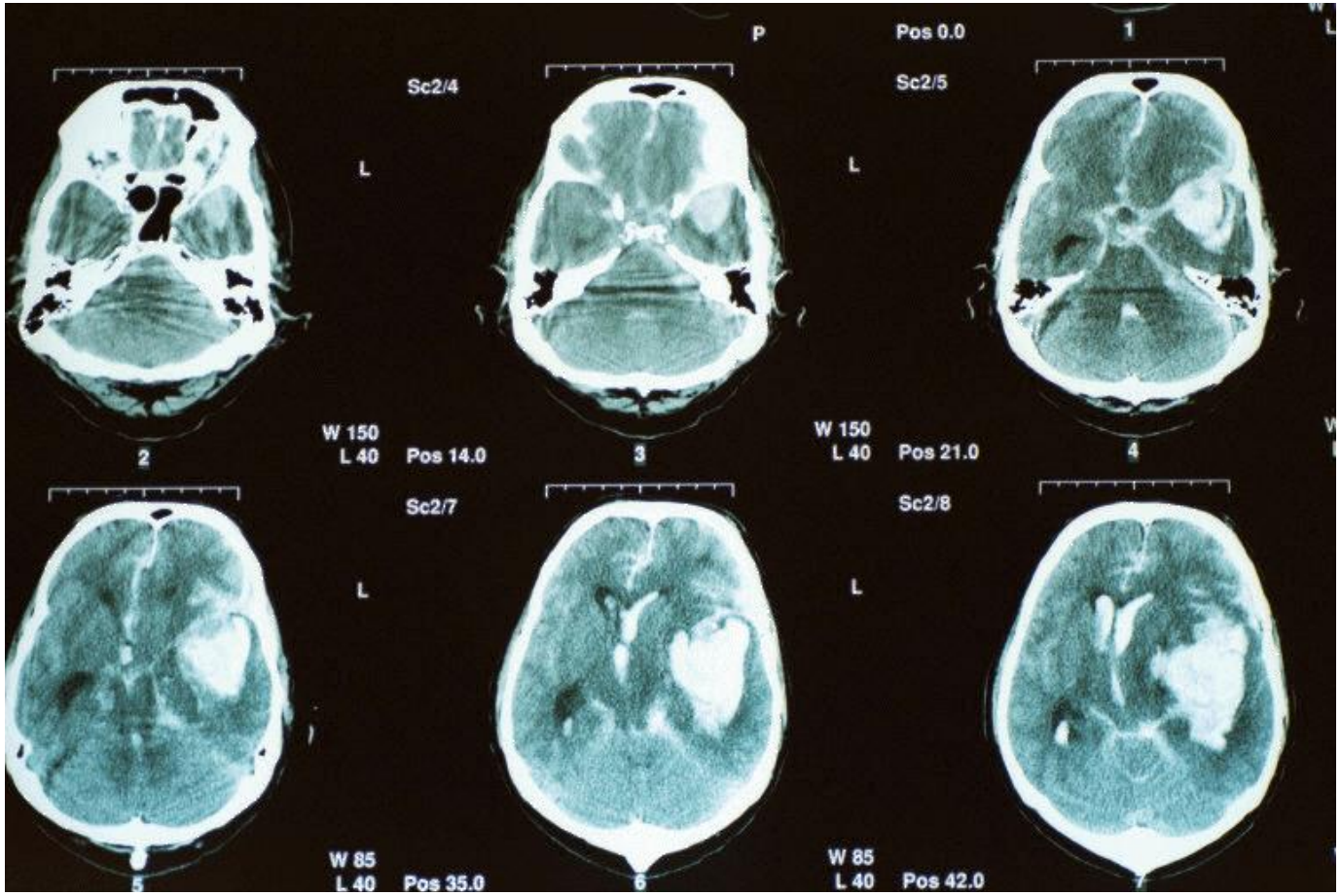
Grade 2 SAH


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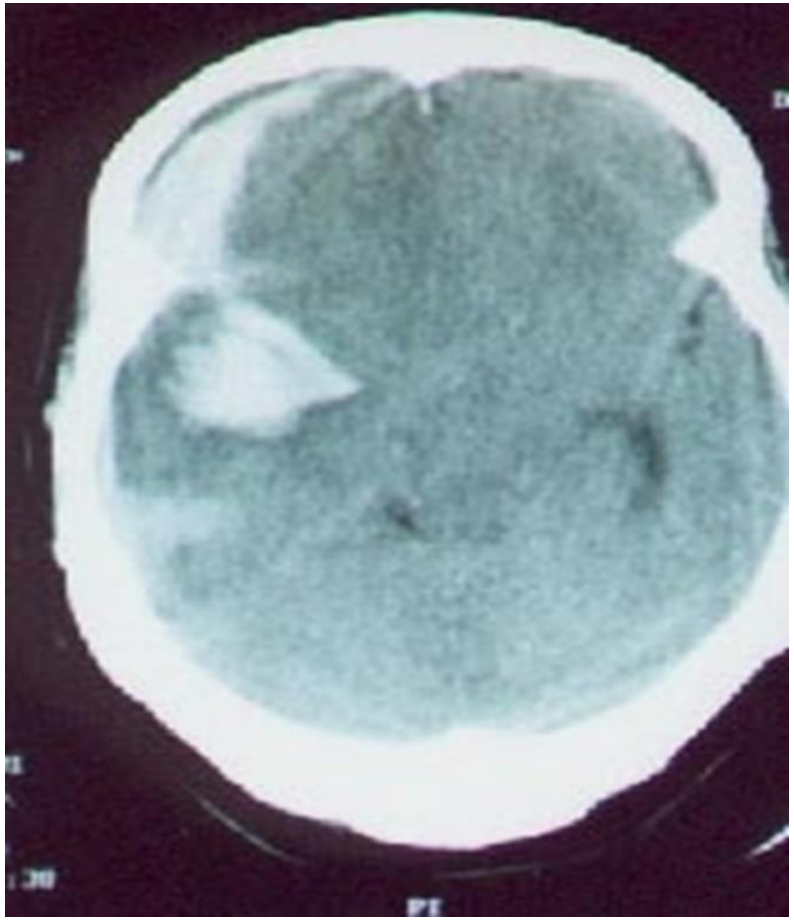
Grade 3 SAH



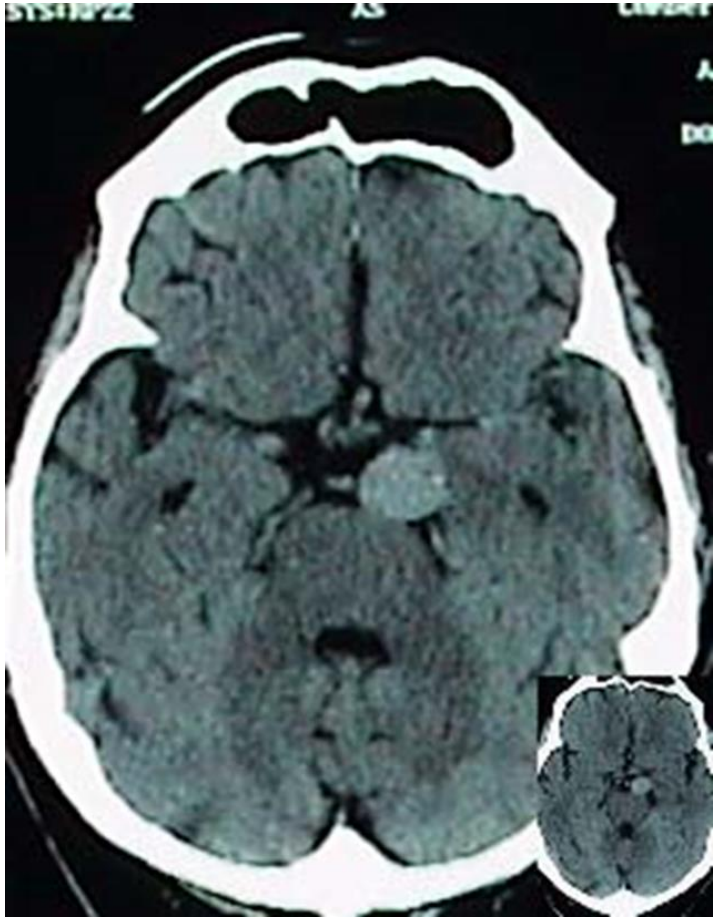
Grade 4 SAH


P
Pos 0.0
Sc2/4
Sc2/5
L
L
1
2
3
4
W 150
L 40
Pos 14.0
W 150
L 40
Pos 21.0
Sc2/7
Sc2/8
L
L
5
6
7
W 85
L 40
Pos 35.0
W 85
L 40
Pos 42.0

Acute aneurysmal SDH



Unruptured Aneurysm on CT

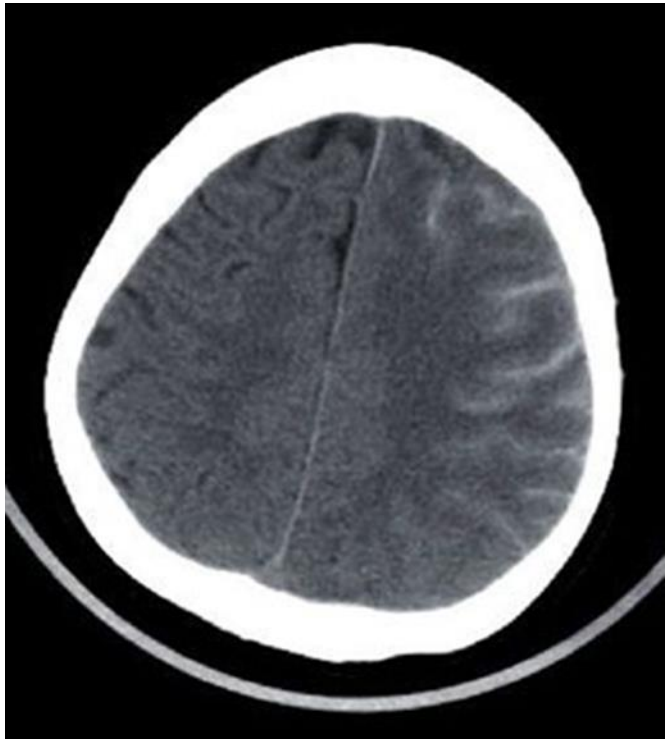


Spontaneous Vs. Traumatic SAH

Spontaneous



Traumatic



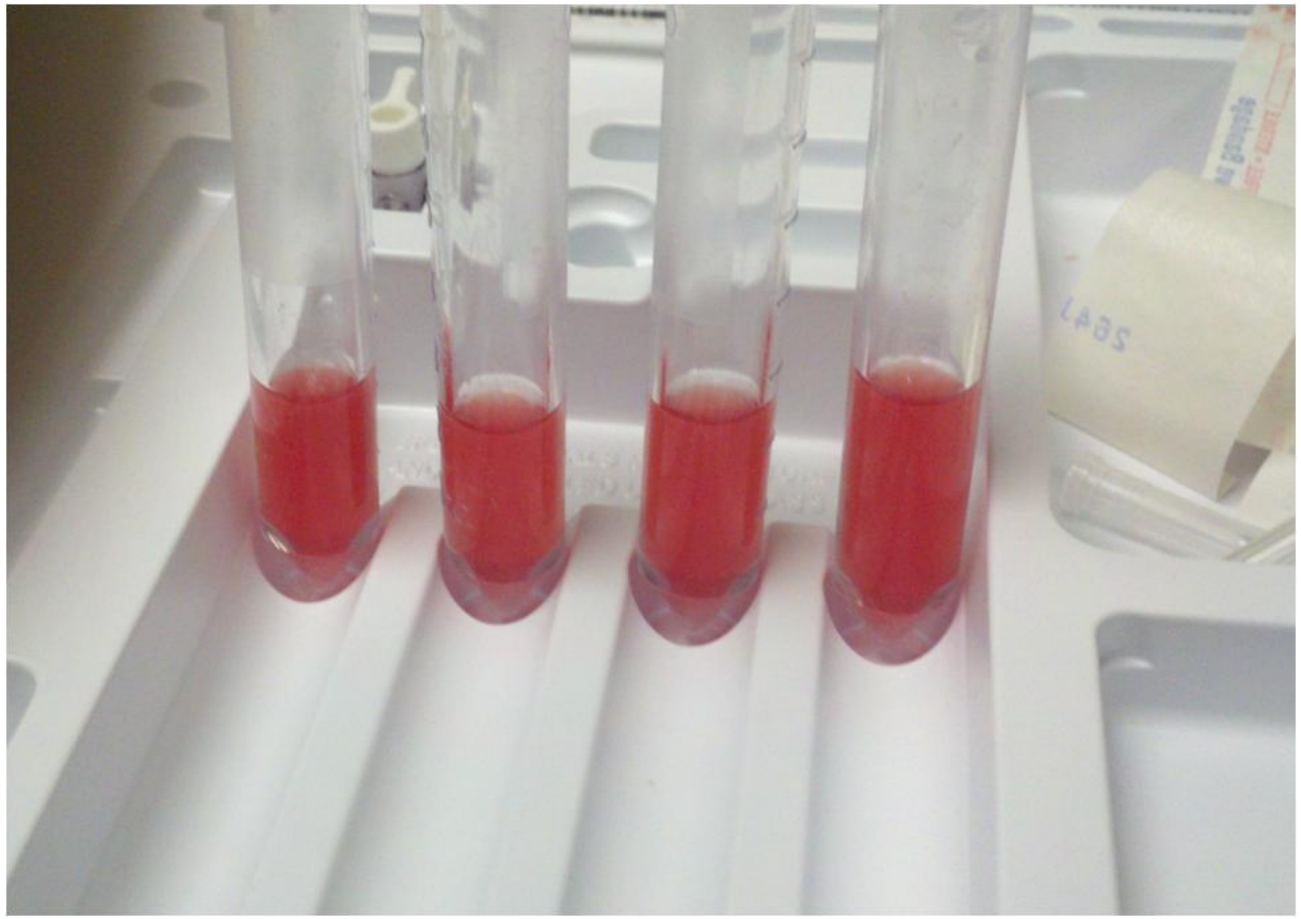
Lumbar Puncture (LP)

- Performed if no SAH on CT, but still it is suspected
- Negative within 2 hours of the ictus, and LP is most sensitive 12 hours after the bleed
- The most sensitive test
- Disadvantages:
  - Invasive
  - False (+) results may occur (traumatic puncture)
  - Lowering CSF pressure may cause rebleed!,
    - ➢ So use small needle <20 Ga & drain small amount

LP Findings

- High opening pressure
- Appearance:
  - Nonclotting, not clearing bloody fluid
  - Xanthochromia (6 hours – 2 weeks)
  - Spectrophotometry
- RBC > 100,000/mm3
- Protein high, Glucose normal or low

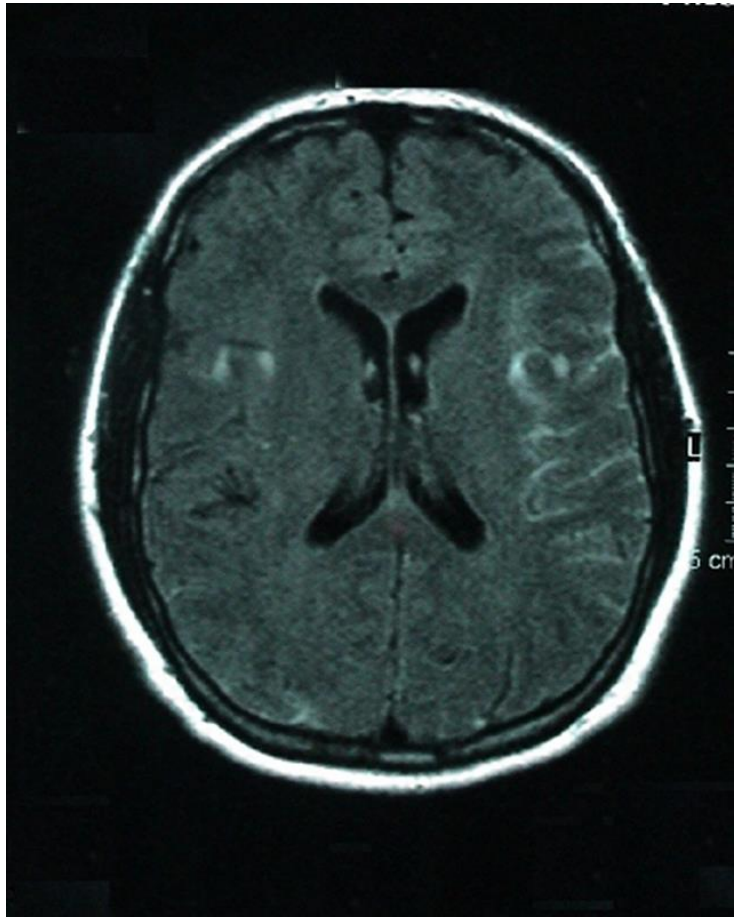
Nonclotting not clearing bloody fluid



MRI (Blood appearance on MRI)

Stage	Time	Hb	T1WI	T2WI
Hyperacute	0-2 hrs	Intracellular Oxy-Hb	Low	High
Acute	2 hrs – 5 days	Intracellular Deoxy-Hb	Low	Low
Early subacute	5-10 days	Intracellular Met-Hb	High	Low
Late subacute	10-20 days	Free Met-Hb	High	High
Chronic	months	Haemosiderin, Ferritin	low	Low

SAH on MRI





Investigations to differentiate the etiology of SAH (Search for aneurysm)

- Cerebral digital subtraction angiogram (DSA)
- Magnetic Resonance Angiogram (MRA)
- Computed Tomography Angiogram (CTA)

Digital Subtraction Angiogram (DSA)

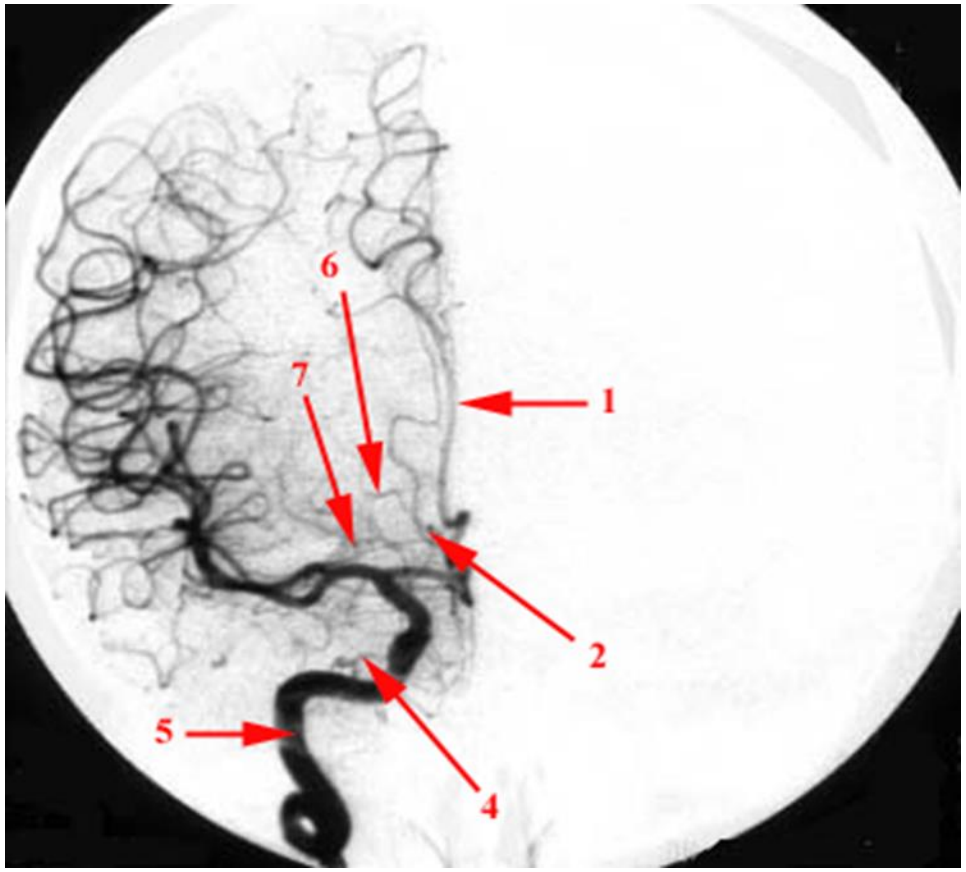
- The gold standard
- Sensitivity 85%
- Detect radiographic vasospasm
- Study the vessel with highest suspicion 1st
- Complete 4 vessel angiography

- Must see: Both PICA & the flow through Acom A

Cerebral Angio provides

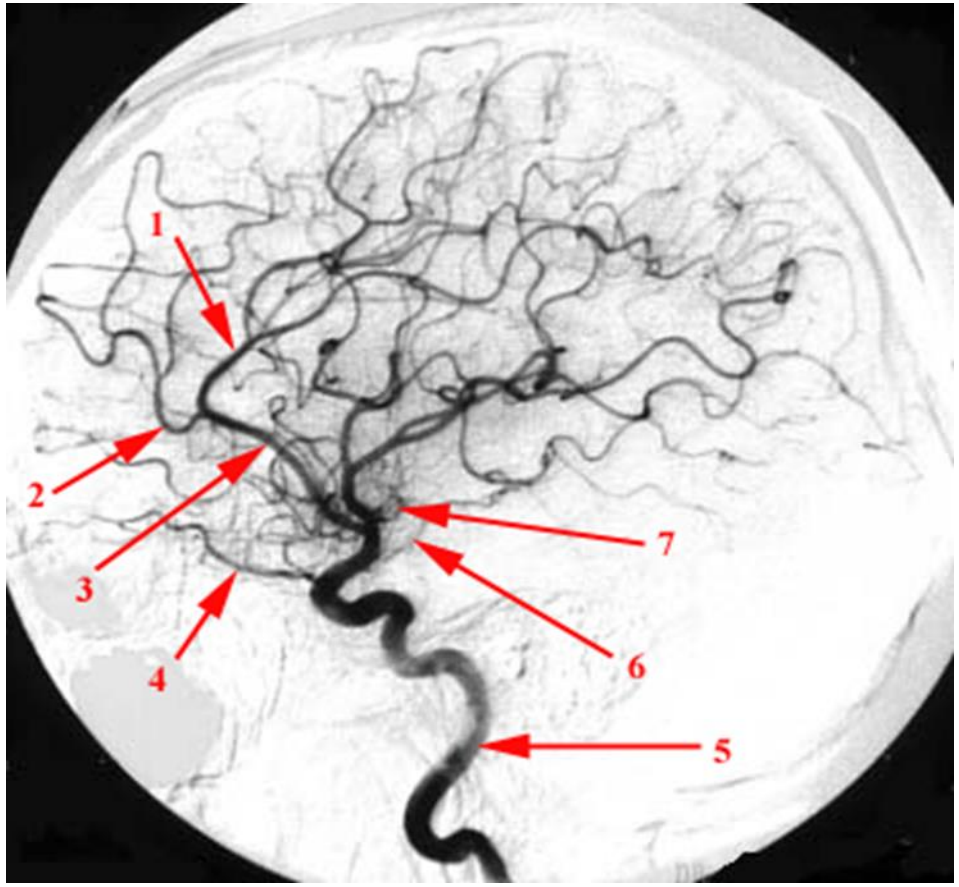
- Cerebrovascular anatomy
- Aneurysm location and source of bleeding
- Aneurysm size and shape
- Orientation of the aneurysm dome and neck
- Relation of the aneurysm to the parent artery and perforating arteries
- Presence of multiple or mirror aneurysms

Carotid angiogram
A-P view



1. Pericallosal artery
2. Callosomarginal artery
3. Anterior cerebral artery
4. Ophthalmic artery
5. Internal carotid artery
6. Anterior choroidal artery
7. Lenticulostriate arteries

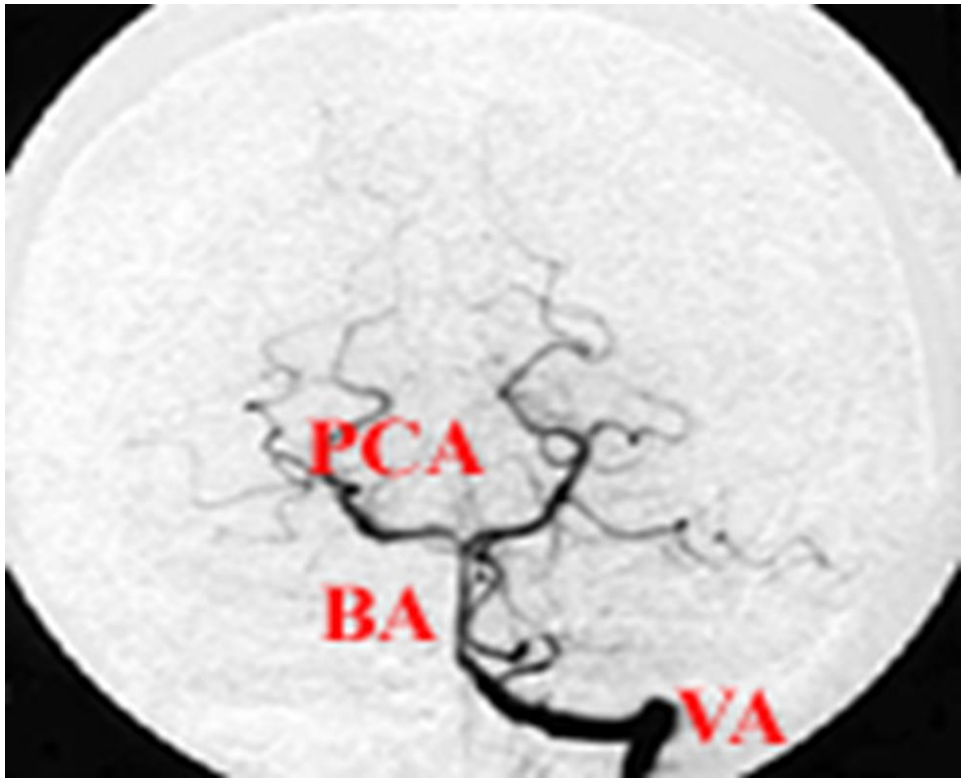
Carotid angiogram
Lateral View



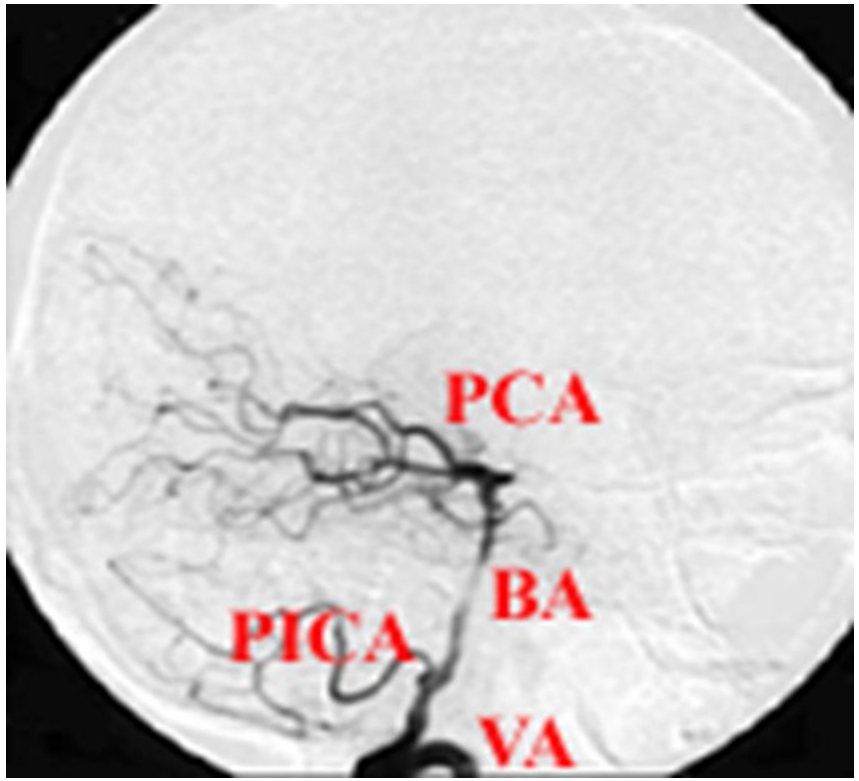
1. Pericallosal artery
2. Callosomarginal artery
3. Anterior cerebral artery
4. Ophthalmic artery
5. Internal carotid artery
6. Anterior choroidal artery
7. Lenticulostriate arteries

Vertebral angiogram

AP View



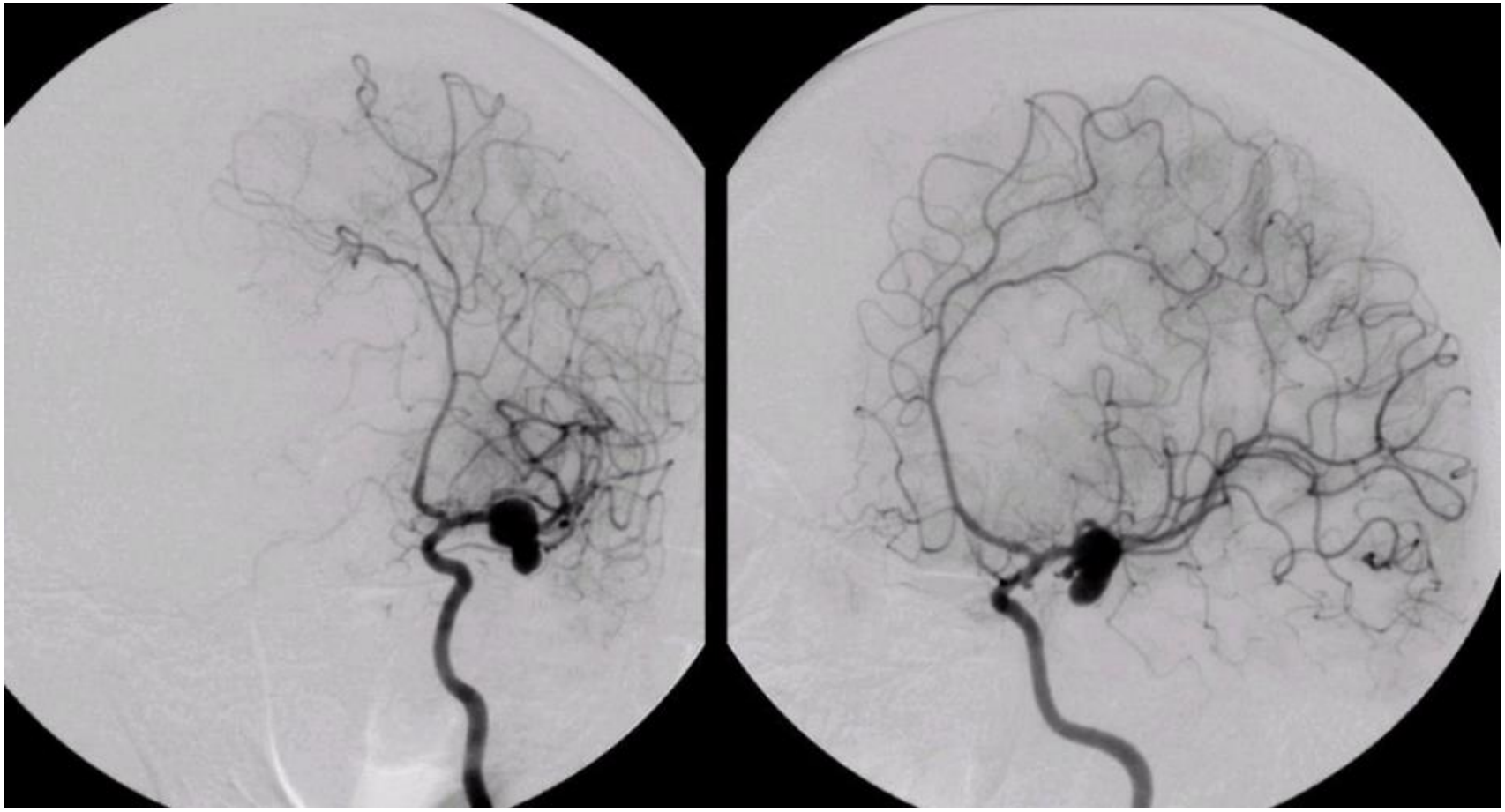
Lateral View



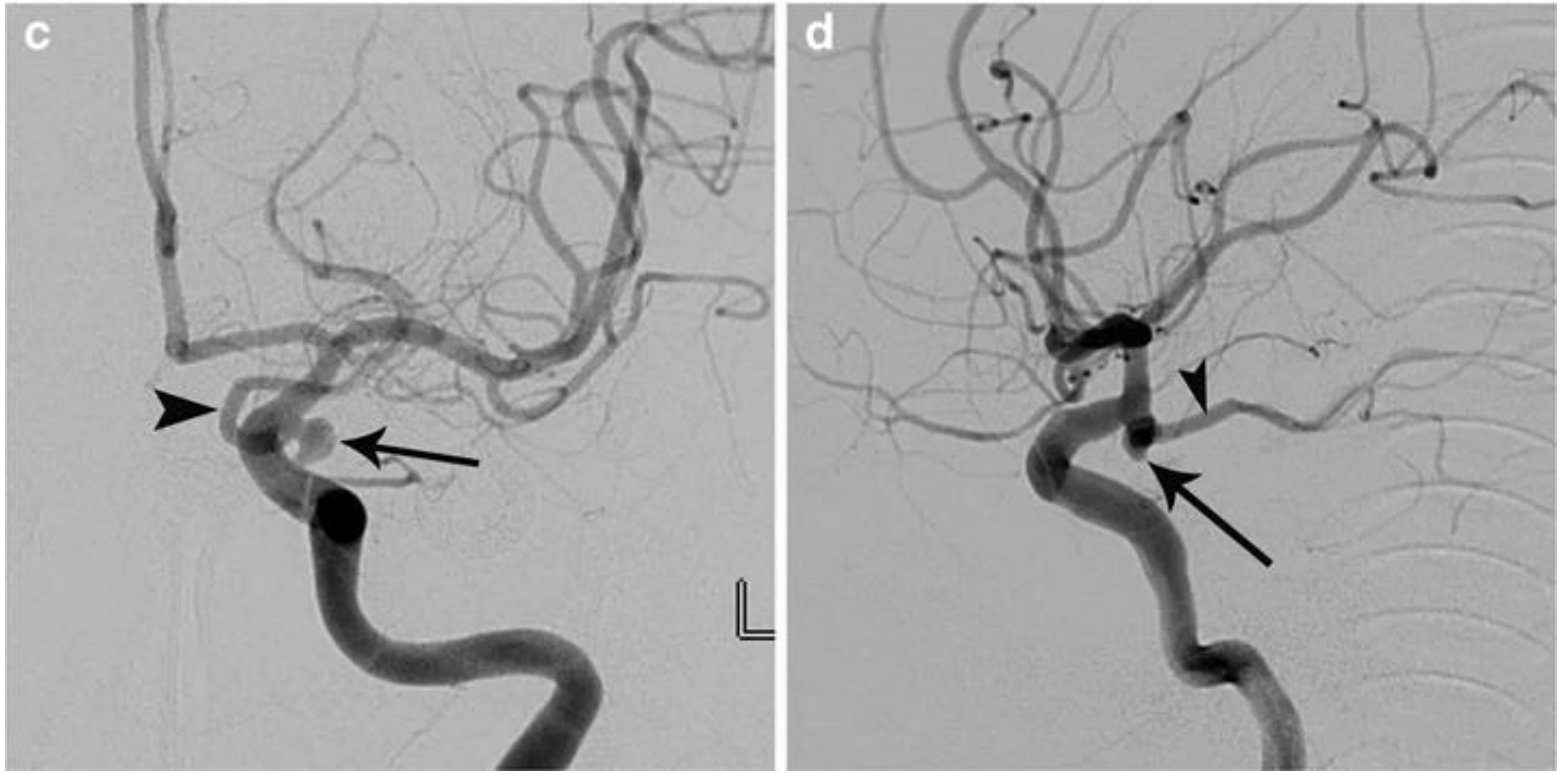
A-com Aneurysm



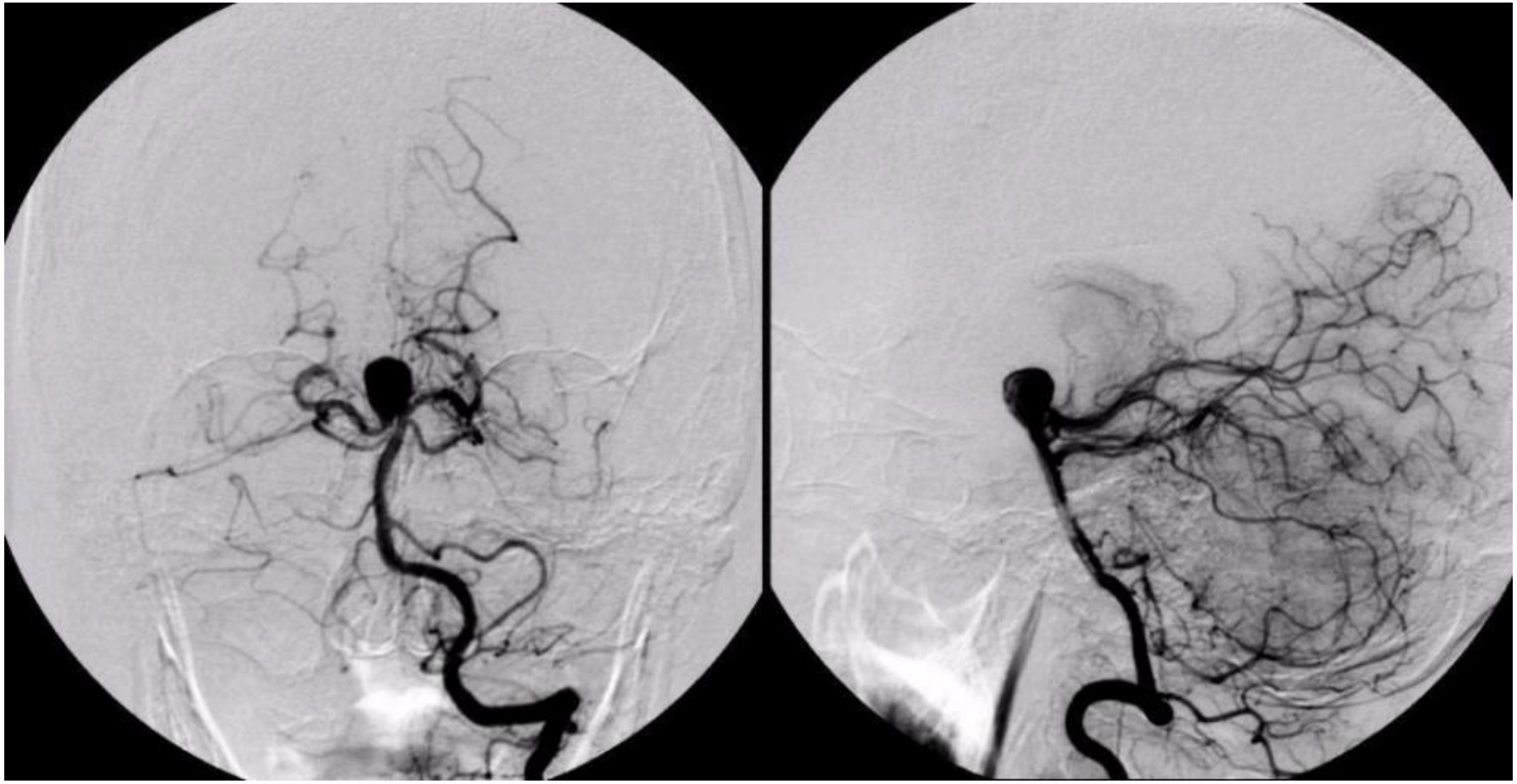
MCA Aneurysm



P-com Aneurysm



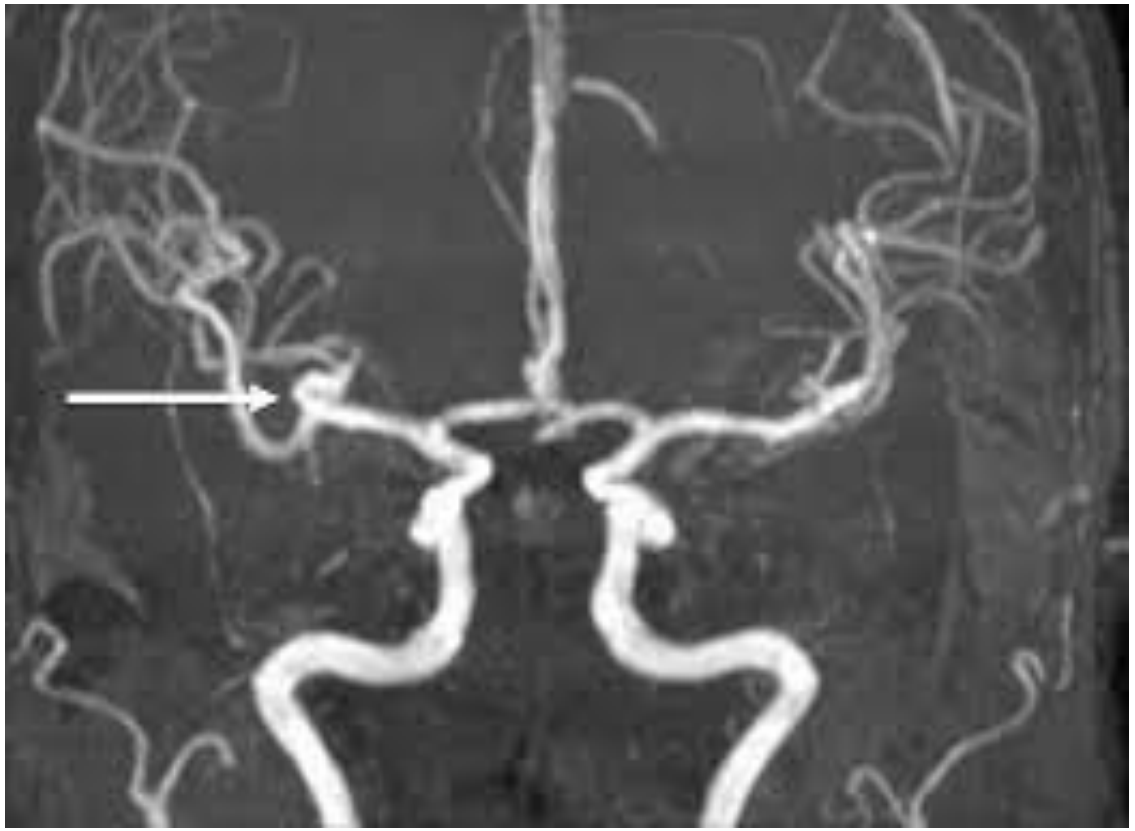
Basilar tip aneurysm



MRA

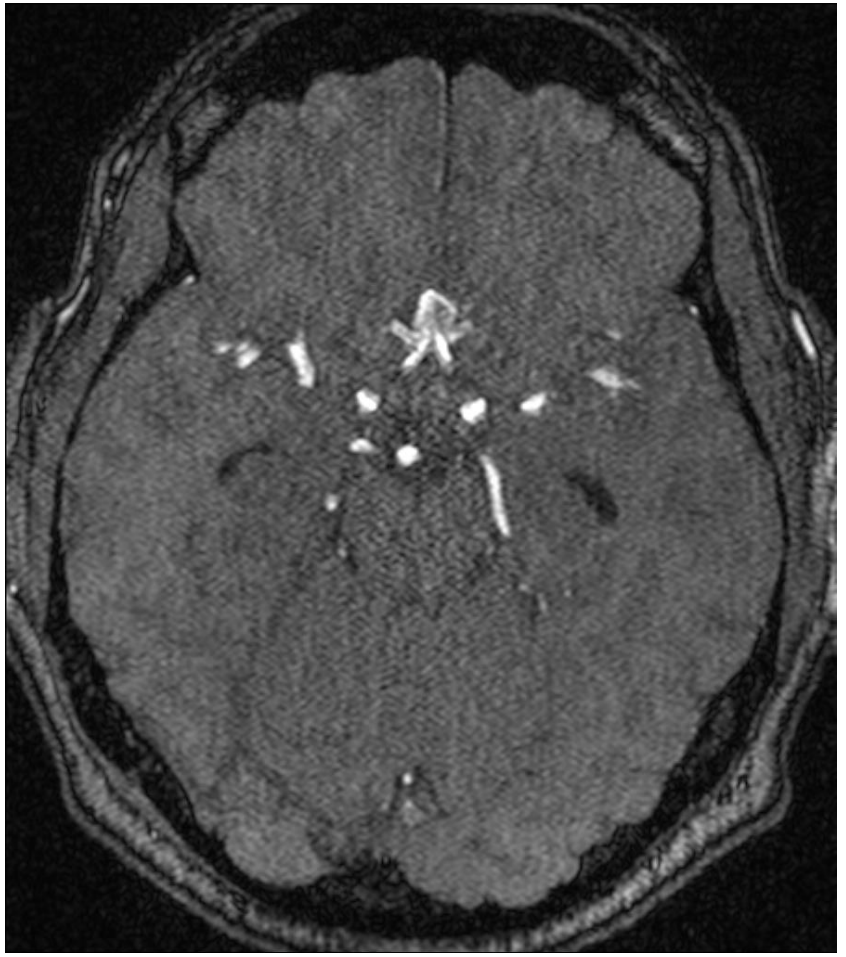
- Experience is evolving
- Sensitivity 86% - 95% (shows aneurysms > 3mm diameter)
- False (+) 16%
- Useful as a screening test
- Provide more information than DSA about aneurysm shape & size of the neck.
- Limitation: Failure to detect PICA

MRA showing MCA aneurysm



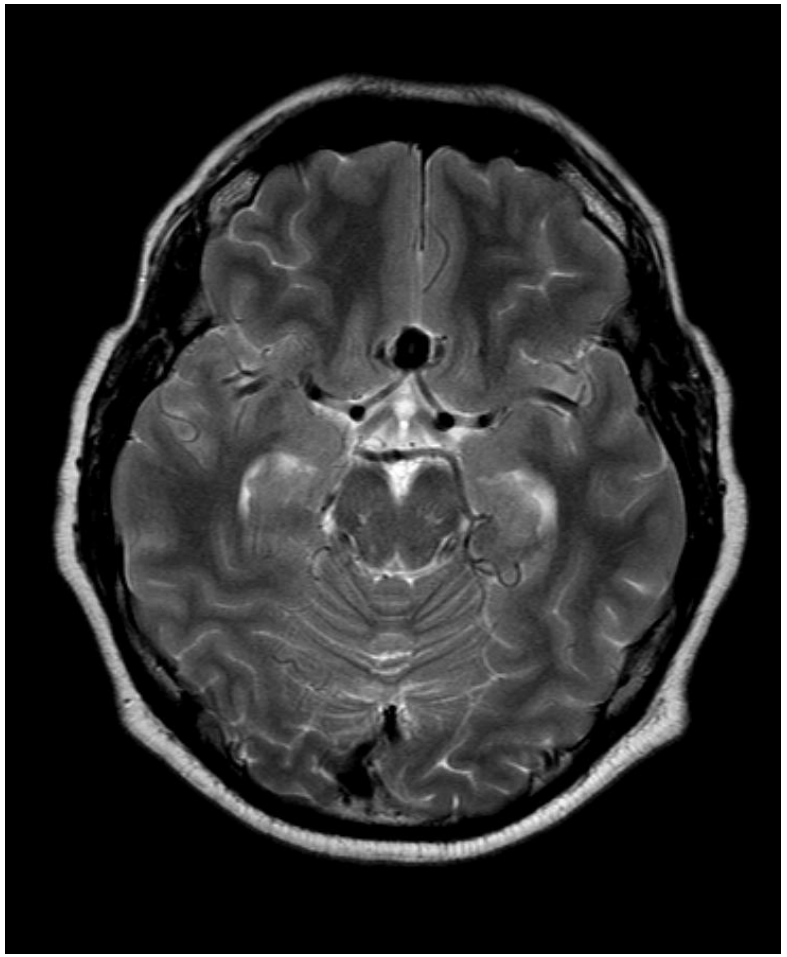
MRA showing A com aneurysm





MRI for the same patient showing flow void





CTA

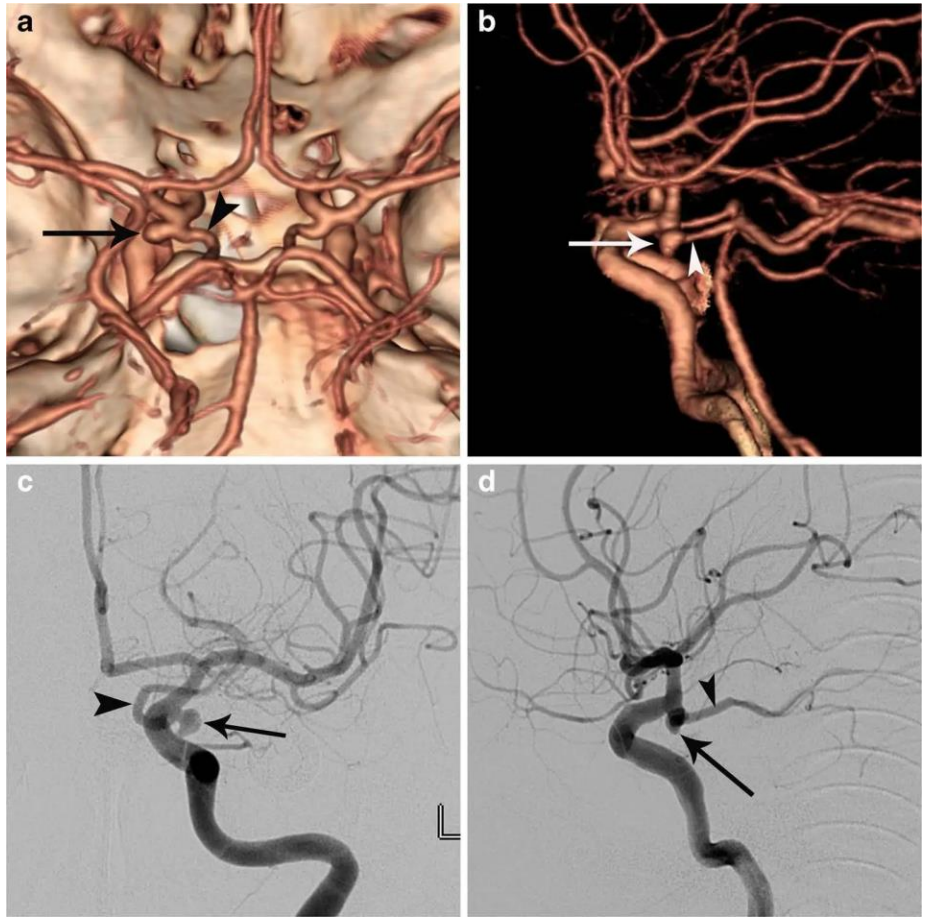
- Sensitivity 95%, specificity 83%
- Detect aneurysm small as 2.2 mm
- Advantages: 3-D relation to bony structures
- Provide more information than DSA about aneurysm shape & size of the neck.

- The best for screening!

CTA



CTA showing P-com Aneurysm



SAH of Unknown Etiology
(Angiogram-negative SAH)

Causes of missed aneurysms:

- Inadequate angiography
- Obliterated aneurysm
- Thrombosed aneurysm
- Small aneurysm
- Vasospasm

SAH of Unknown Etiology
(Angiogram-negative SAH)

What to do?

- Repeat angio after 2 weeks
- CT is helpful in decision to repeat
- Don’t repeat for classical pretruncal SAH or if no blood on CT
- MRI, MRA, CTA

- Rule out spinal AVM! (by MRI)

SAH of Unknown Etiology
(Angiogram-negative SAH)

Investigations for other causes:

- PT, PTT
- Sickle-cell screen
- Toxicology screen (cocaine)
- Tissue plasminogen activator
- Check for vasculitis

Investigations during the management of SAH

Laboratory:

- CBC
- Serum electrolytes (Na+!!)
- PT, APTT
- Blood type and screen
- Cardiac enzymes
- ABG

Investigations during the management of SAH

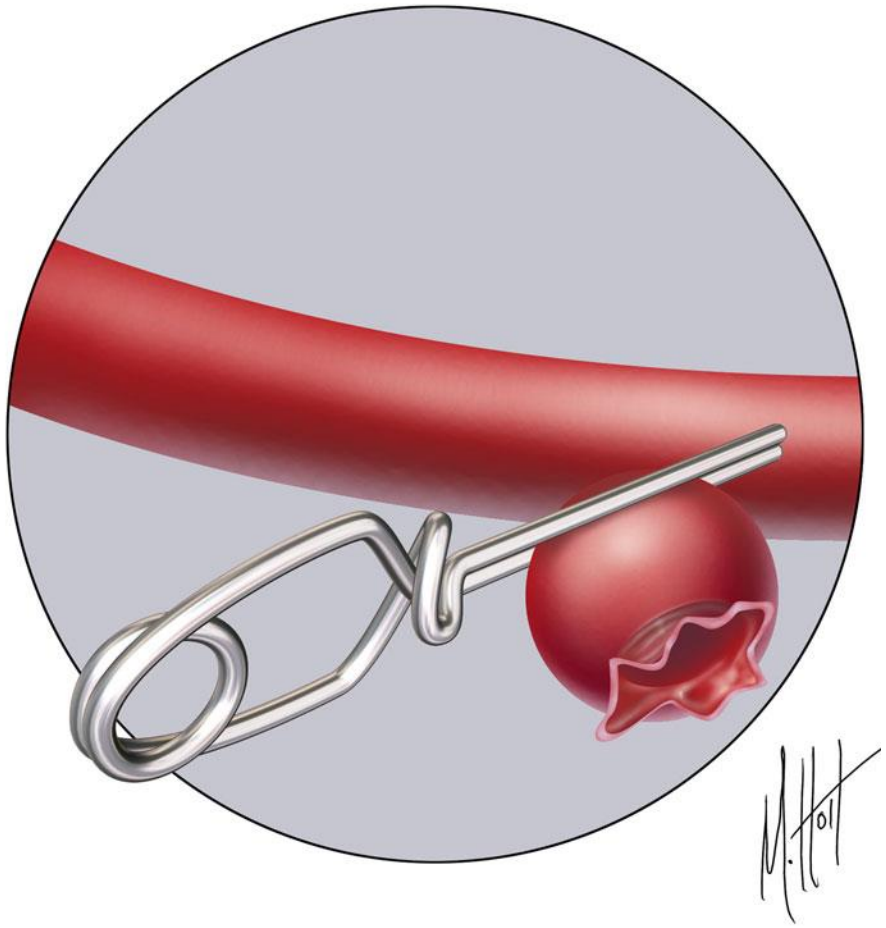
Radiological:

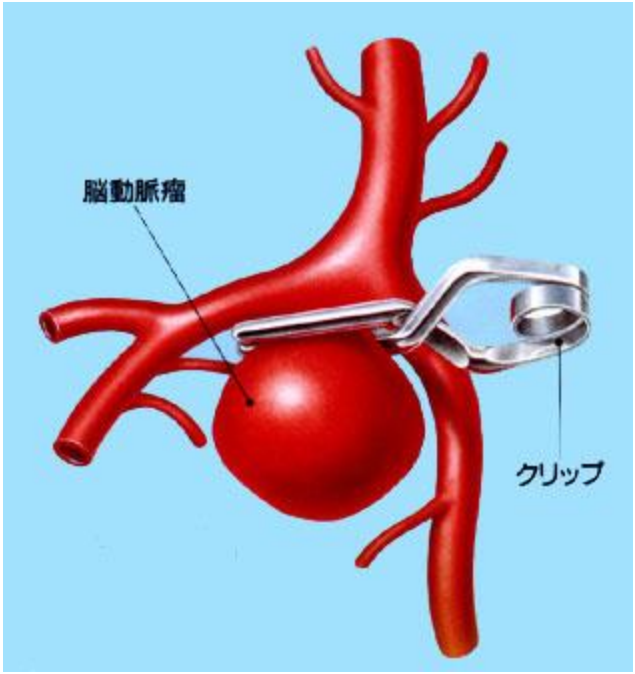
- CT follow up (HCP, Rebleeding)
- Transcranial Doppler studies – vasospasm!
- Chest radiograph: as a baseline!
- Echocardiogram: myocardial ischemia!

Treatment options for aneurysms

- Surgical clipping: the gold standard
- Endovascular coiling

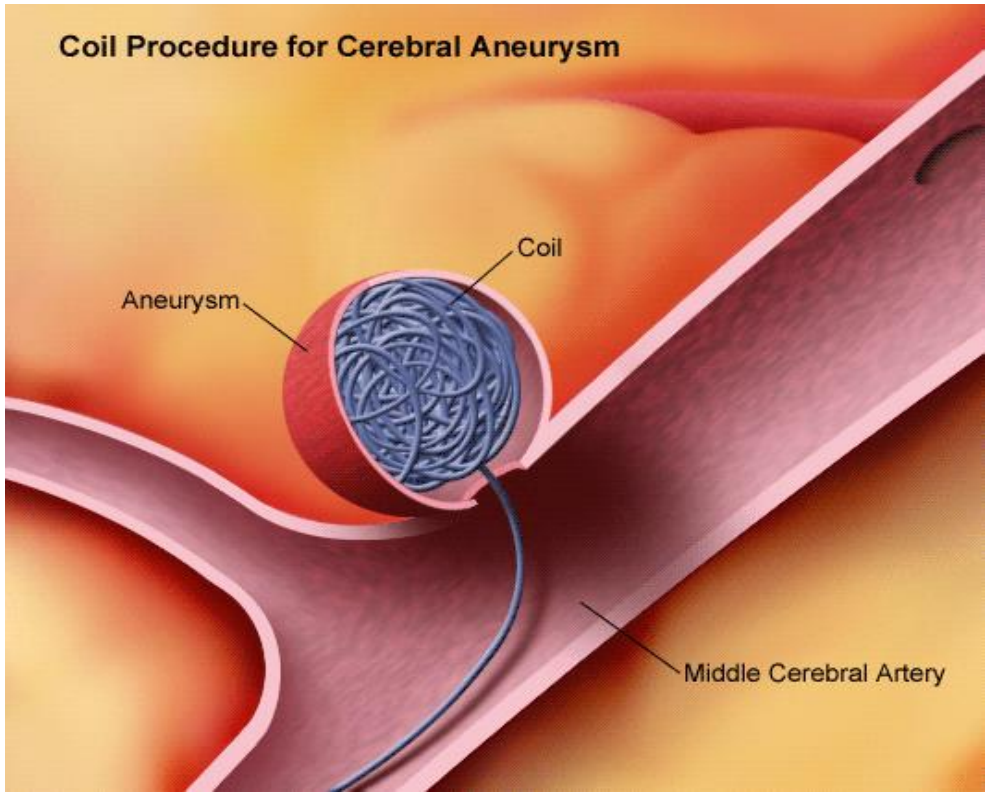
Clipping





Coiling




Coil Procedure for Cerebral Aneurysm
Coil
Aneurysm
Middle Cerebral Artery

Clipping vs. Coiling

Clinical Trial > Lancet. 2005 Sep;366(9488):809-17. doi: 10.1016/S0140-6736(05)67214-5.

International subarachnoid aneurysm trial (ISAT) of neurosurgical clipping versus endovascular coiling in 2143 patients with ruptured intracranial aneurysms: a randomised comparison of effects on survival, dependency, seizures, rebleeding, subgroups, and aneurysm occlusion

Andrew J Molyneux [1], Richard S C Kerr, Ly-Mee Yu, Mike Clarke, Mary Sneade, Julia A Yarnold, Peter Sandercock; International Subarachnoid Aneurysm Trial (ISAT) Collaborative Group

Affiliations + expand

PMID: 16139655 DOI: 10.1016/S0140-6736(05)67214-5

Thanks



Any Questions?