CEREBRAL AVMS

NEUROSURGERY LECTURE

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MCQS ON ANEURYSMS

1 The "gold standard" for evaluation of cerebral aneurysm is

A.   lumbar puncture   B   MRI

C.   CT angiography   **D**   **cerebral angiogram**

2 the maximum frequency of rebleed in aneurysmal SAH is on

A   **day 1**   B   day 2

C   day 3   D   day 4

risk is maximum day 1 (4%), then 1.5% daily upto 13 days, 15-20% first 14 days, 50% within 6 months

3 the single most common site for aneurysm formation is

A   **anterior communicatin g artery**   B   posterior communicating artery

C   distal anterior cerebral artery   D   middle cerebral artery

4 the most common posterior circulation aneurysm is

A   PICA aneurysm B   Basilar artery aneurysm

C   **Basilar tip aneurysm** D   AICA aneurysm

BTA is 5% of all aneurysms

VA-PICA are second most common posterior circulation aneurysms

5 about "mycotic" aneurysm

A   4% of all intracranial aneurysm

B   3-15% with SABE

C   most common location distal MCA

D   **all are true**

6 about pediatric intracranial aneurysms, all are true EXCEPT

A 0.5-4.6% incidence

B male predominance and inversion of sex ratio

C ICA bifurcation is the most common

D rebleeding in pediatric is similar to adults

E vasospasm is better tolerated in young age

rebleeding is significantly higher in pediatrics and related to delayed diagnosis

CEREBRAL AVMS
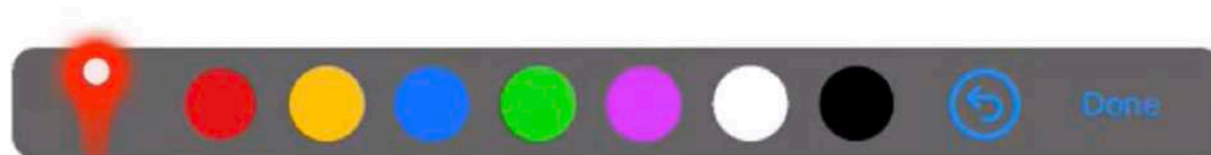
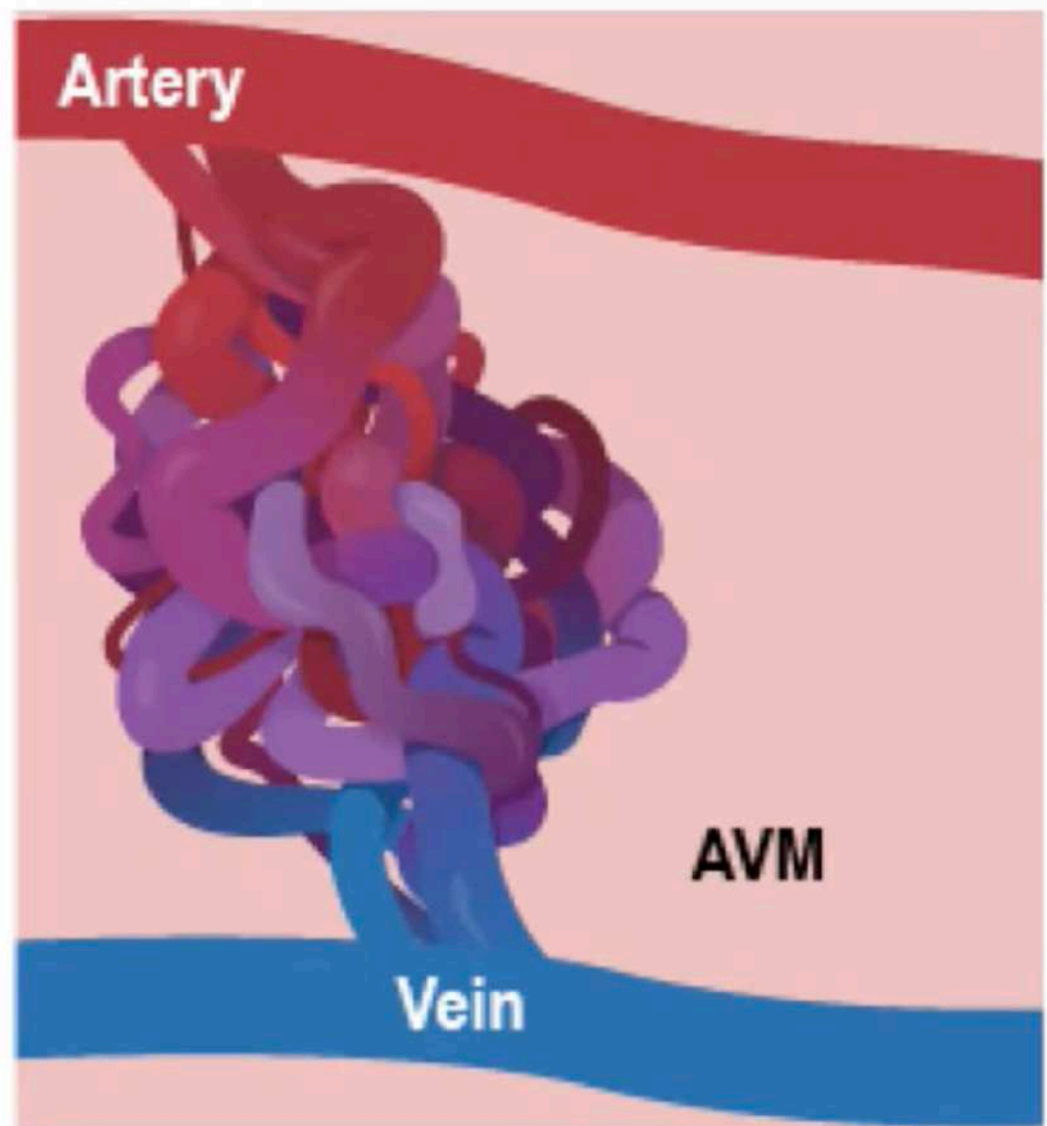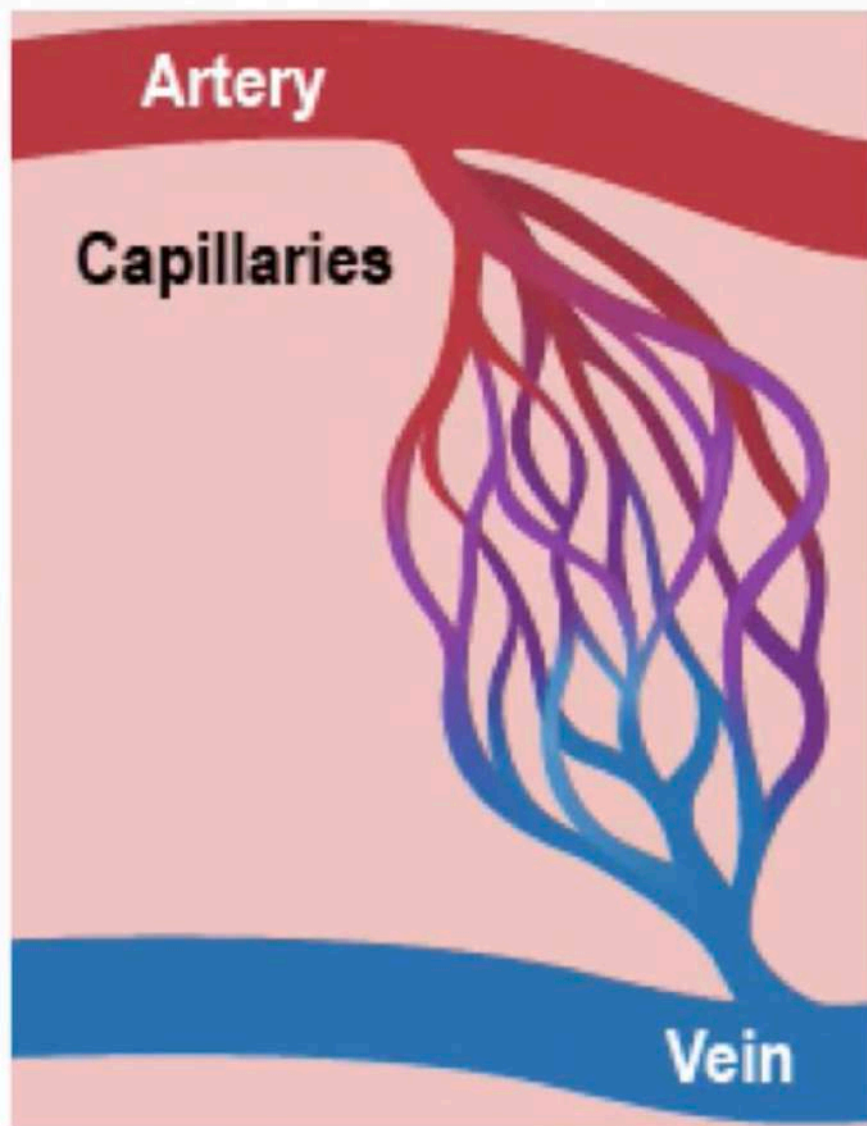# VASCULAR MALFORMATIONS

McCormick classification 1966

Type	Prevalence (%)
1 Arteriovenous malformation	44-60
2 Cavernous malformation	19-31
3 Capillary telangiectasia	4-12
4 Developmental venous anomaly – aka venous angioma	9-10

Others include

Arteriovenous fistula (VOGM, dural AVF, CCF)

Mixed or unclassified. 11% of AOVM

Angiographically Occult vascular malformat

Artery

Capillaries

Vein

Artery

AVM

Vein

ARTERIOVENOUS MALFORMATIONS

A collection of dysplastic dilated blood vessels wherein arterial blood flows directly into draining veins without the normal interposed capillary beds

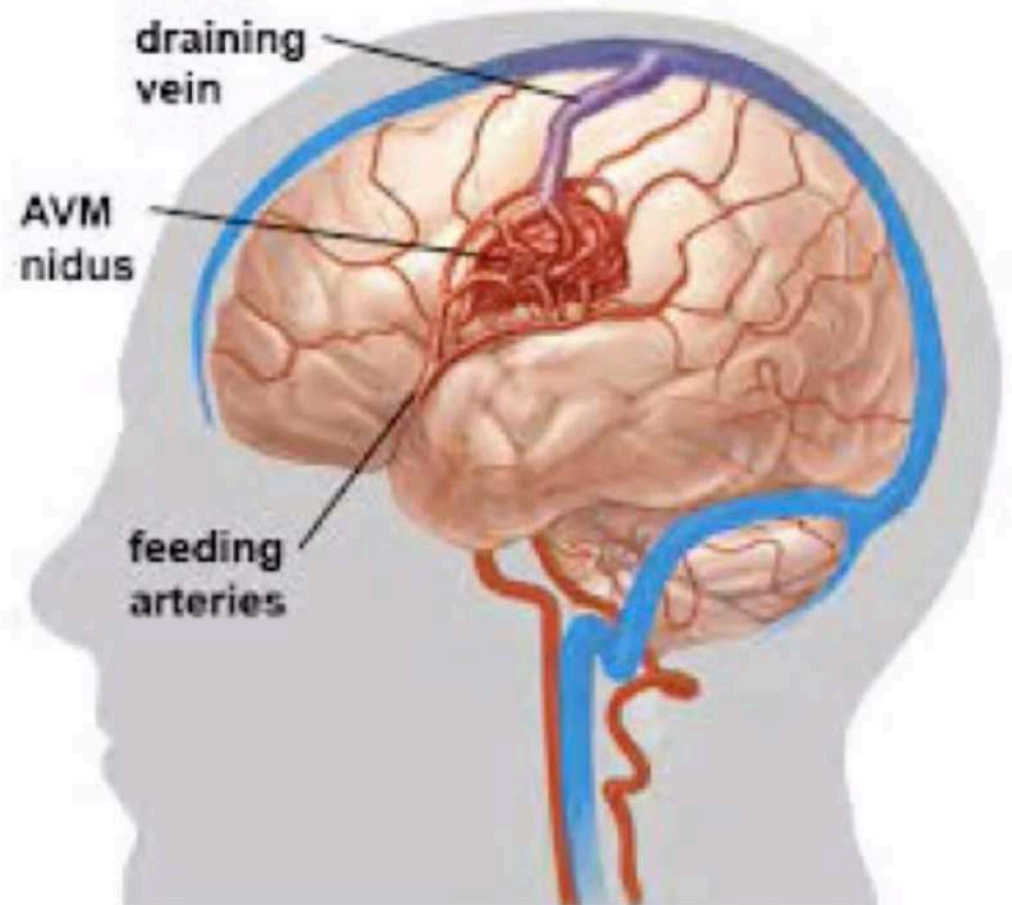- Dysplastic dilated vessels (neither arteries nor veins)

CHARACTERISTICS

- Congenital (usually)

- Enlarge somewhat with the age

- Progress from low-flow juvenile lesions → medium-to-high flow high-pressure lesions in adulthood
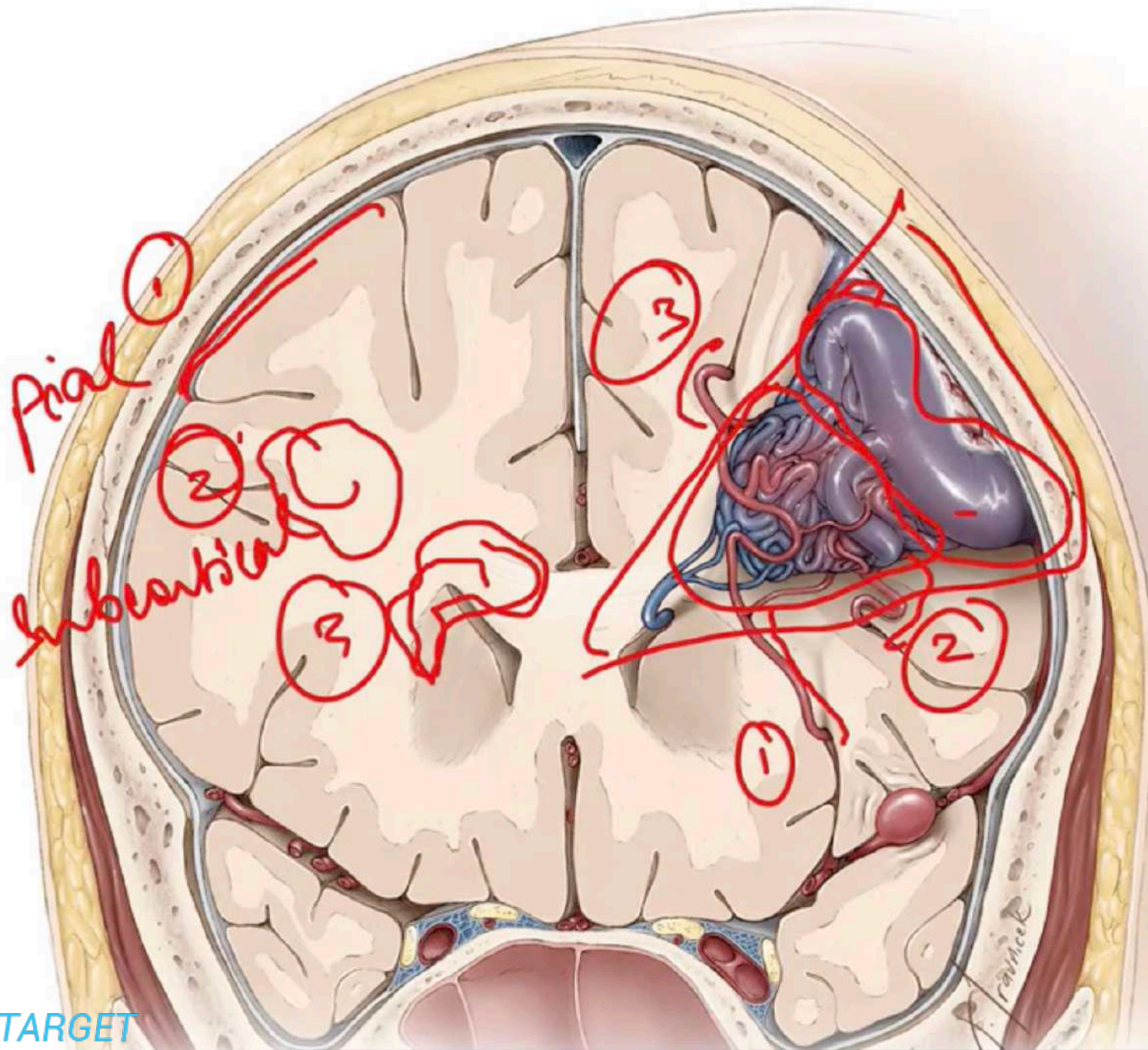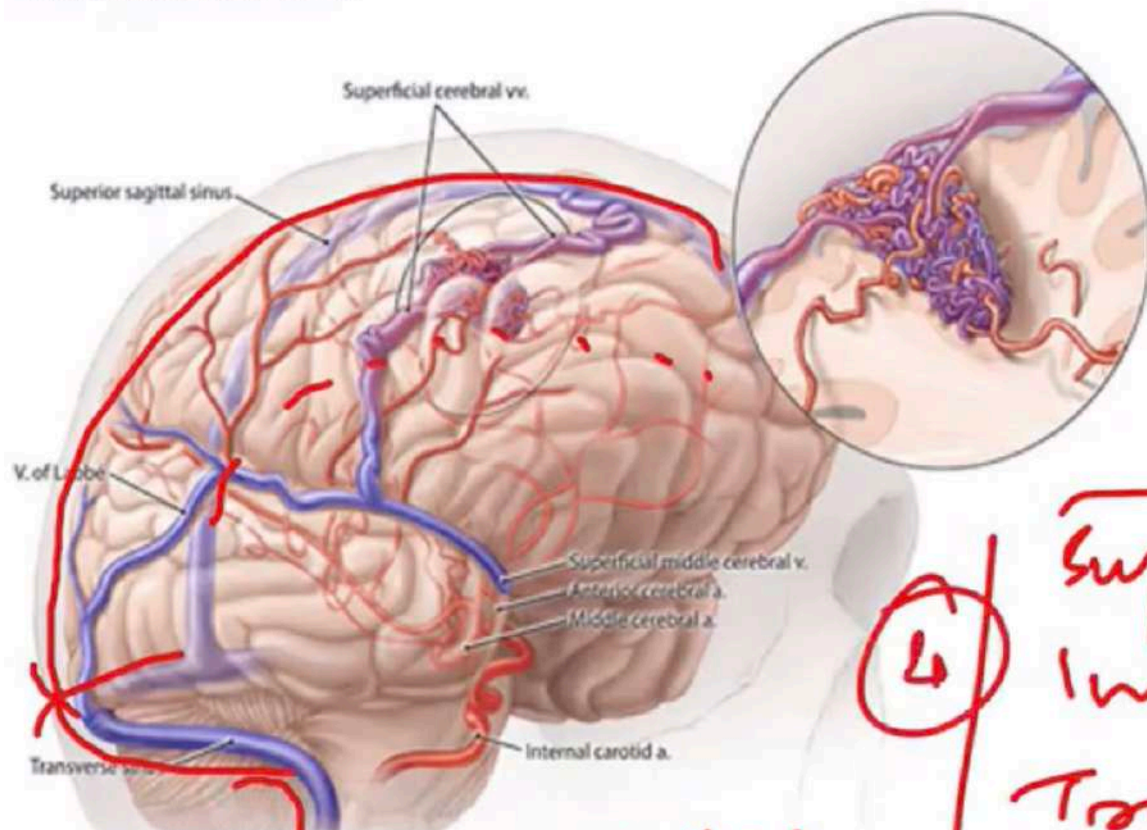
"tangle" of vessels

Well-circumscribed center (the nidus)

Draining "red veins"

draining vein

AVM nidus

feeding arteries

CLASSIFIED AS ..

1. **Parenchymal AVMs**
   a) Pial
   b) Subcortical
   c) Paraventricular
   d) Combined
2. **Pure dural AVM**
3. **Mixed parenchymal and dural (rare)**

Pial

Subcortical

Arteriovenous Malformation

Superficial cerebral vv.

Superior sagittal sinus

V. of Labbe

Superficial middle cerebral v.
Anterior cerebral a.
Middle cerebral a.

Internal carotid a.

Transverse

① Superficial

② Deep

④
Sup. Sag. Sinus
Int Sag. Sinus
Transverse Sinus
Sigmoid Sinus

① Cerebellar veins

① Cortical Veins

IJV

Superficial Venous Drainage

Deep Venous Drainage
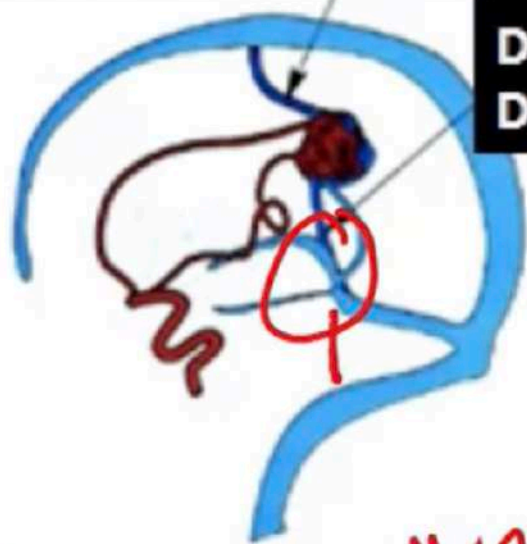
Deep Venous System

① & Pre. cerebellar (Vermian) vein

② 1. Vein of Galen
2. Int. cereb. vein
3. Basal Veins (Rosenthal)
4. Deep. Middle Cerebral Vein

EPIDEMIOLOGY

Prevalence – 0.14%

Slight male preponderance
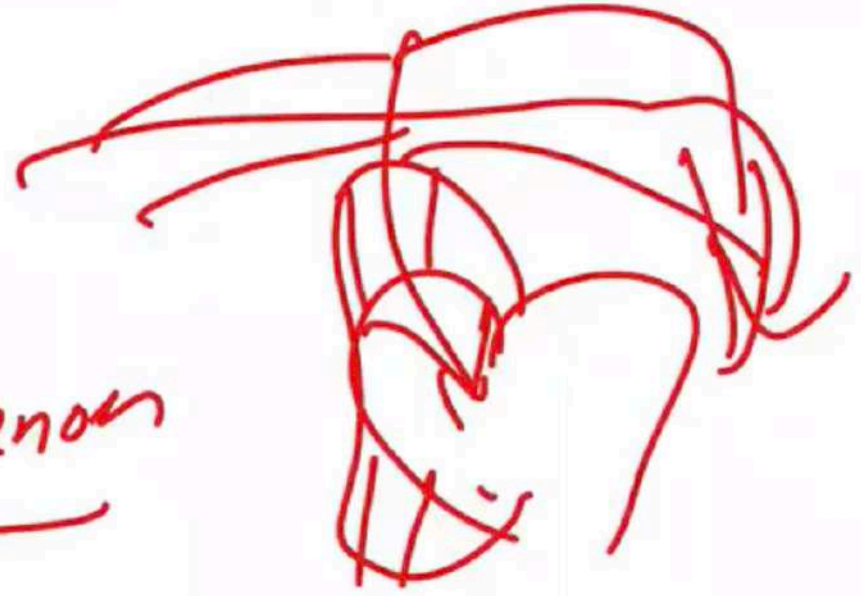
Average age at diagnosis: 33 years

Syndromes :
- Osler-Weber-Rendu syndrome (hereditary hemorrhagic telangiectasia) – 15-20% incidence

PRESENTATION

1. Hemorrhage: 58% (c.f. 92% for aneurysms)
2. Seizures: 34%
3. Others: 8%
   - Mass effect, ischemia, headache, bruit, raised ICP
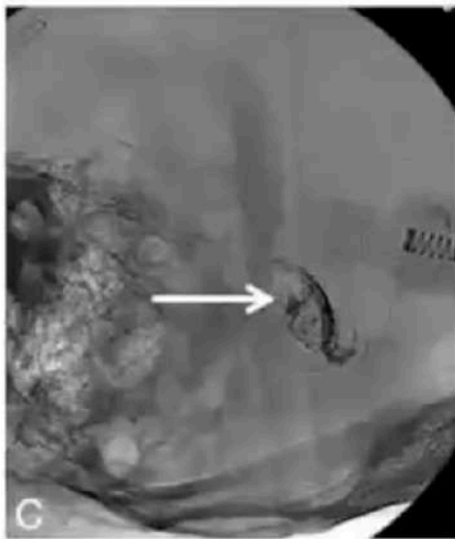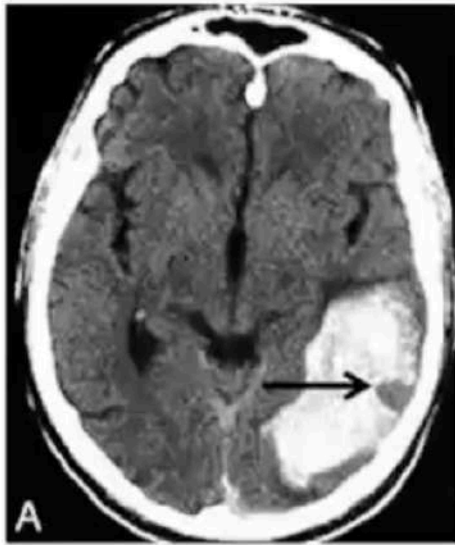   - Hydrocephalus
   - Congenital heart failure

steal phenomenon

HEMORRHAGE

Location

1. Intraparenchymal (ICH): 82%
2. Intraventricular (IVH)
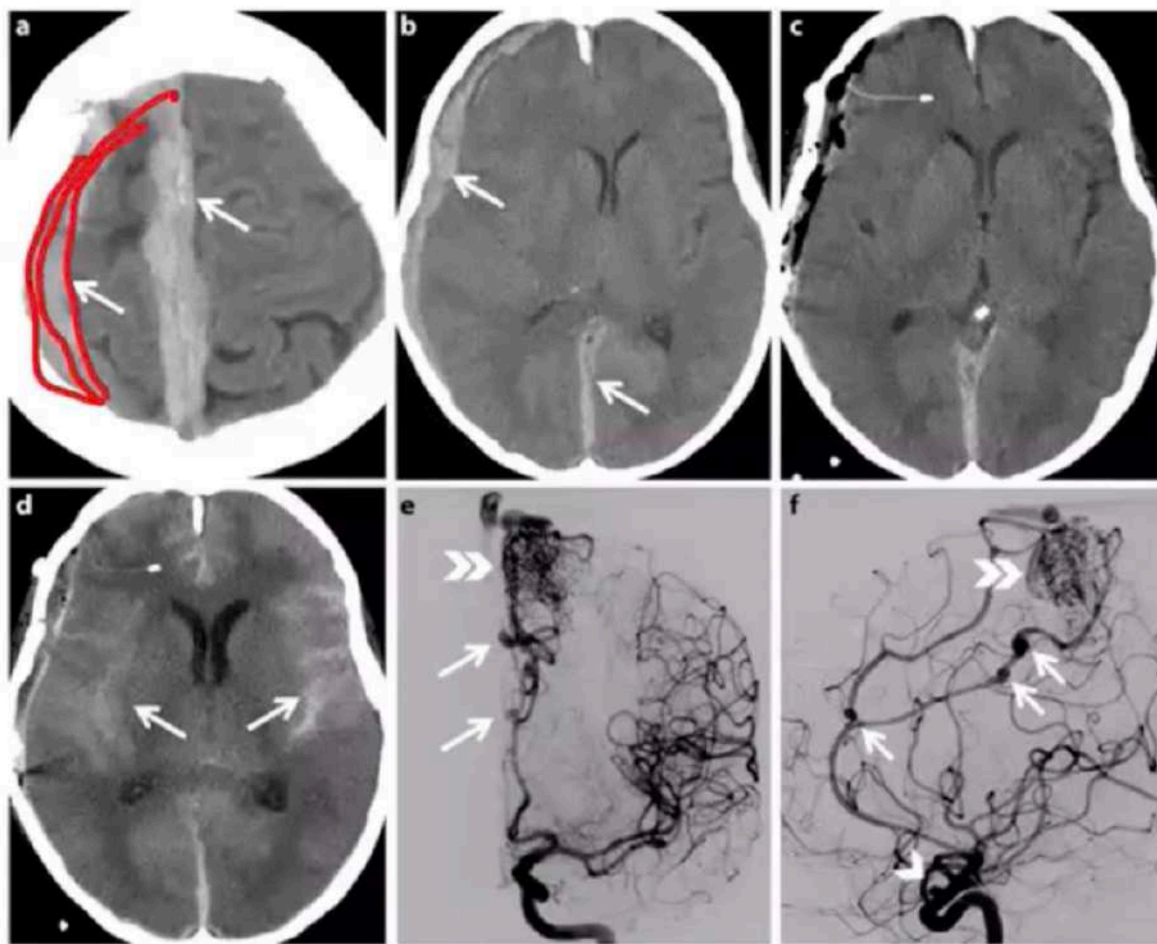3. Subarachnoid (SAH)
4. Subdural (SDH)

IVH

ICH+IVH

Risk of hemorrhage

- Annual risk 2.3%
- Re-rupture 4.3%
- Highest during first year
- 30% increase risk per decade

Factors

- **Size: NO association found**

- **Drainage pattern: 1.6-2.4 fold with deep venous drainage**

- **Grade: higher with grade 4-5**

Age

Deep V.

Grade

Venous drainage	Nidus location	No prior hemorrhage	Prior hemorrhage
No deep venous drainage	Not deep	0.9%	4.5%
	Deep	3.1%	14.8%
Deep venous drainage	Not deep	2.4%	11.4%
	Deep	8.0%	34.4%
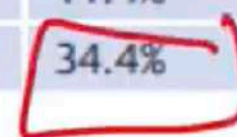
SEIZURES

Mechanism – unknown
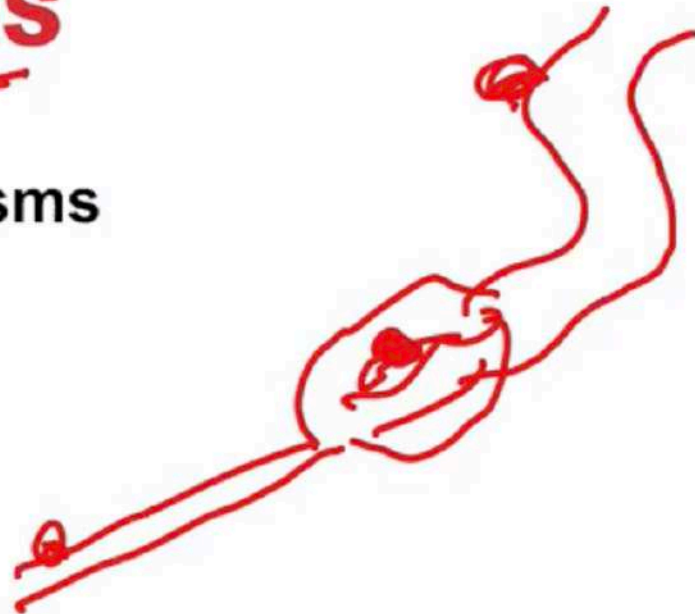
The younger patient at diagnosis: the higher risk

Risk factors:
- Temporal location
- Cortical involvement
- Nidus > 3cm
- Hemorrhage

| Age at diagnosis (years)	20-year risk of developing seizures
10–19	44%
20–29	31%
30–60	6%

AVM WITH ANEURYSMS

7% AVMs have associated aneurysms

75% located on the feeder artery
Others in the nidus / draining vein

Treatment priority
- Tandem AVM and aneurysm, treat symptomatic first
- If not clear, odds are with aneurysm

Venous system

Draining vein

Intra-nidal

Unrelated
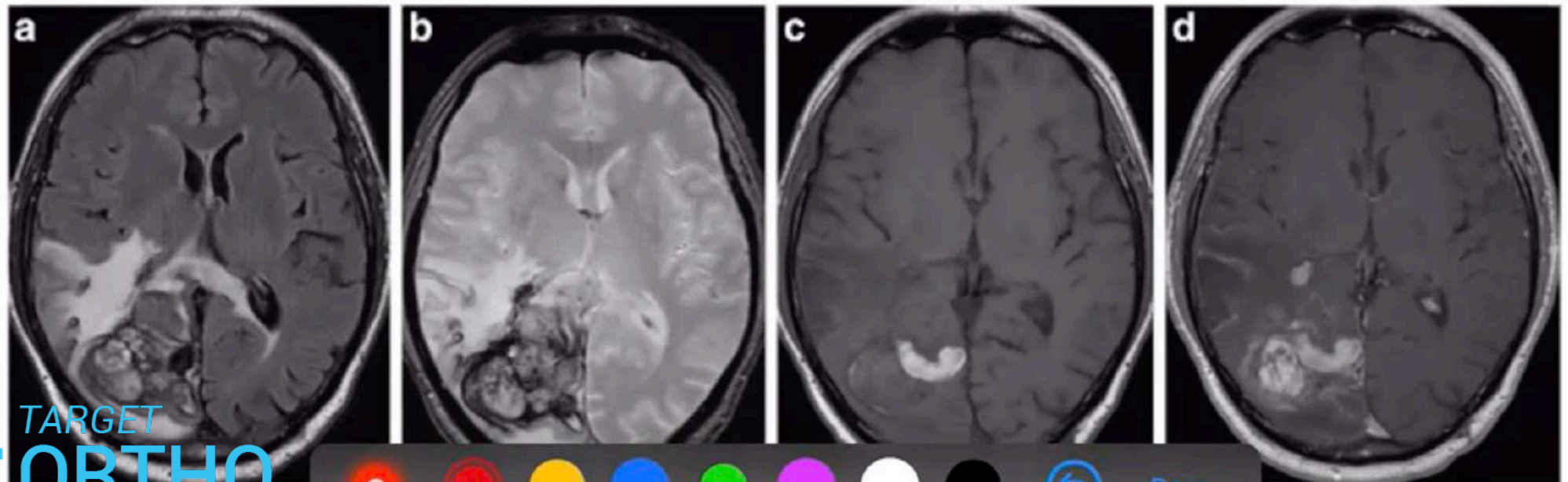
feeding A.

Parent A.

1
2
3
4
5
6
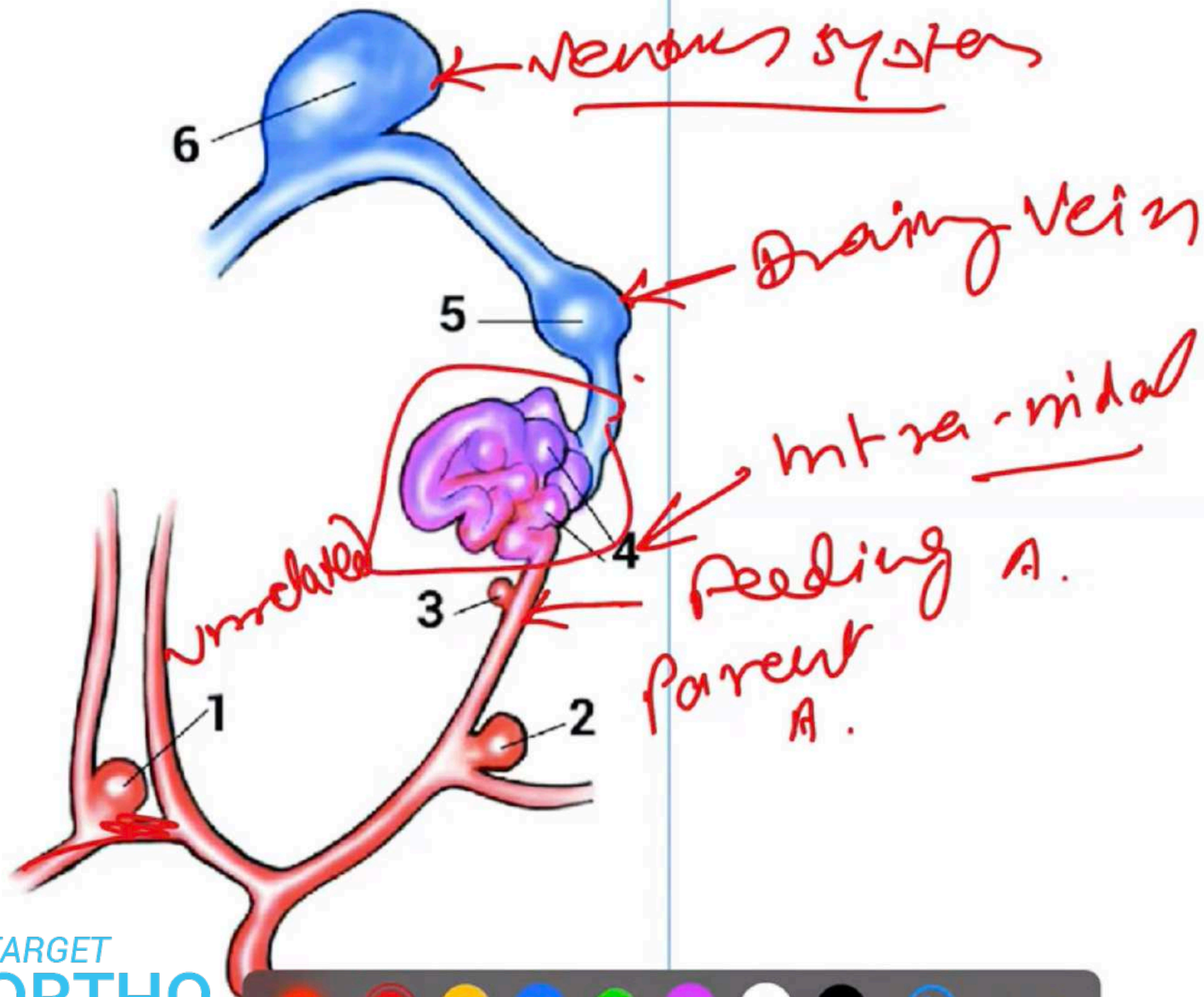
DIAGNOSIS

Various imaging modalities

- Best: catheter angiography – diagnosis & planning

- Next: CT angiography – shows angiogenic properties

- MR angiography – close to CTA
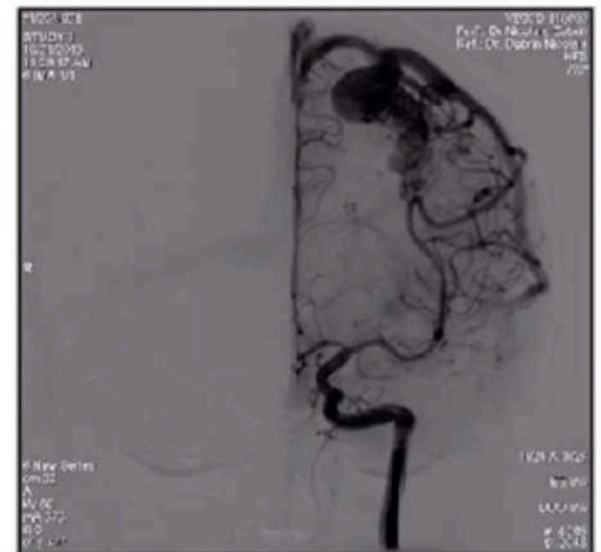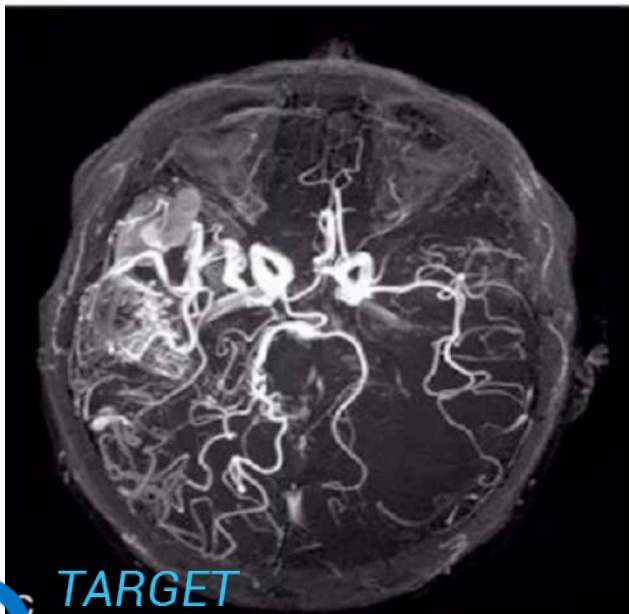
MRI and MRA

- Flow voids

- Less edema

- Hemosiderin ring

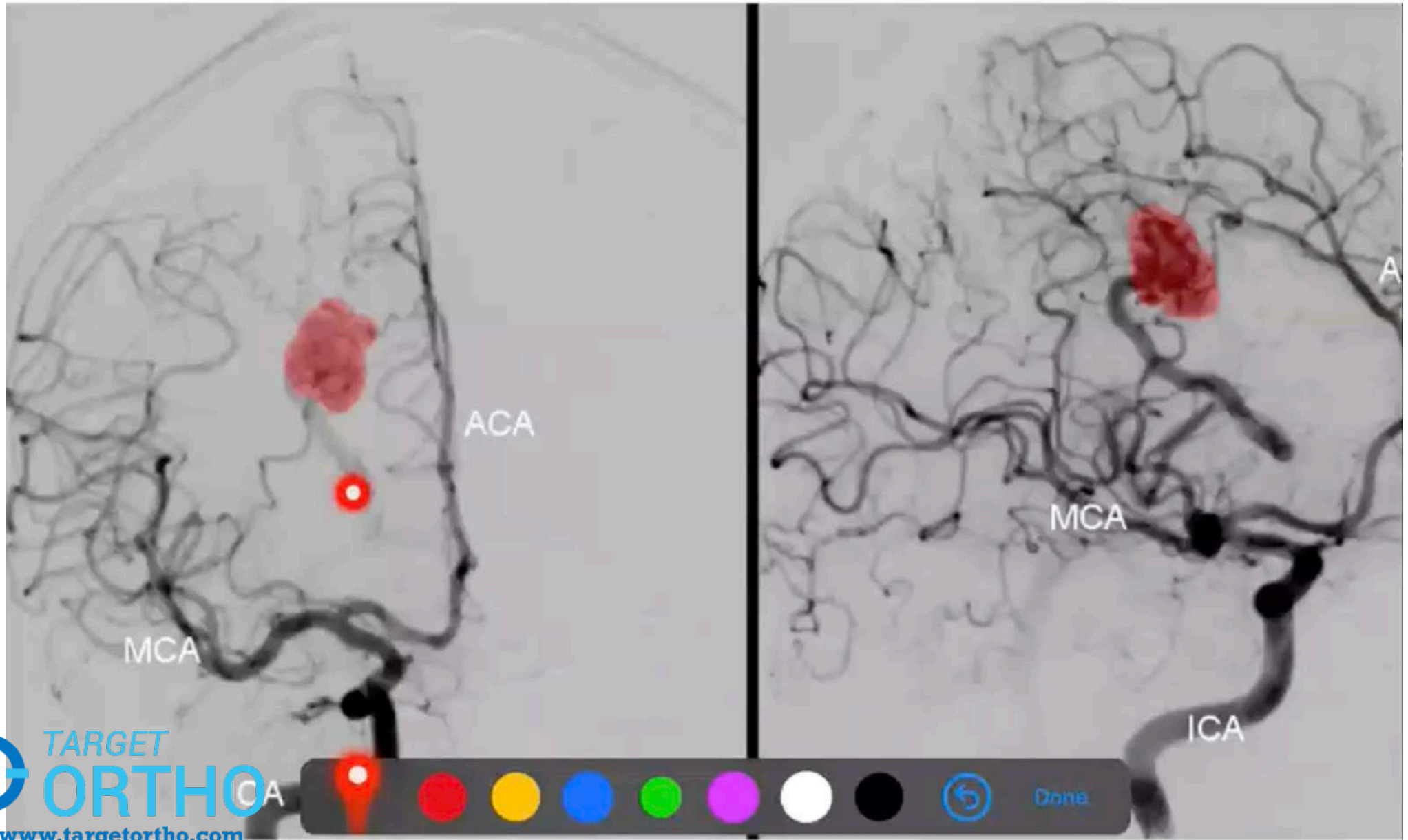- MRA can detect upto 1mm vessels and upto 10mm AVMs

CTA

- In presence of ICH, comparable to DSA

DSA

- Tangle of vessels
- Large feeder
- Large drainer
- Draining veins seen in arterial phase

AVM GRADING

① Size
< 3 cm
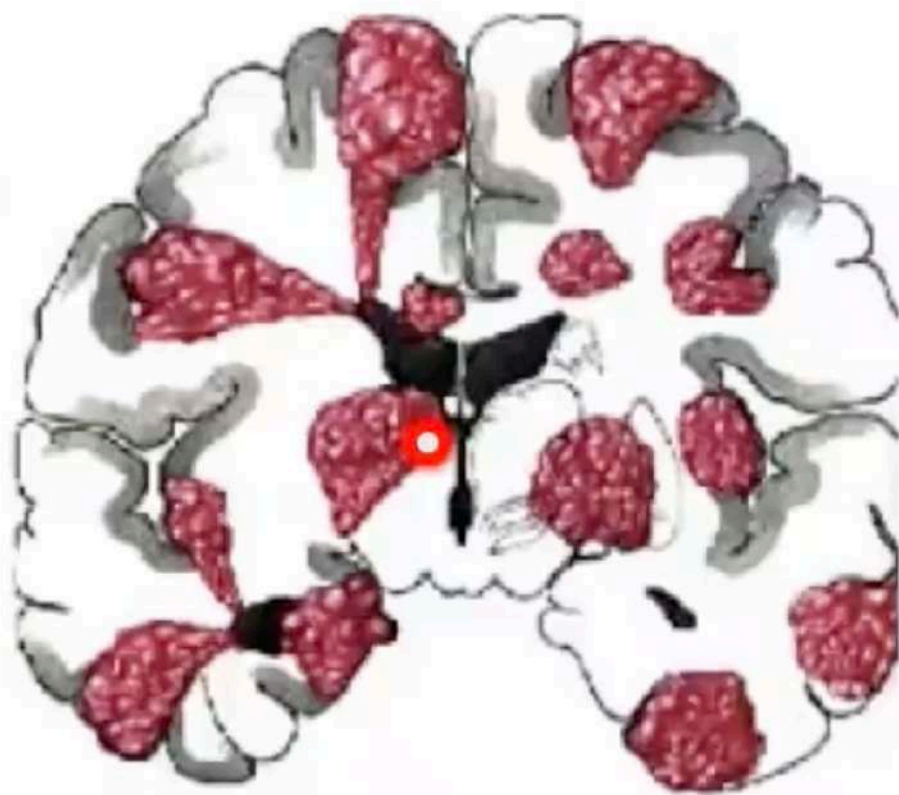3 - 6 cm
> 6 cm

Spetzler-Martin grading system **② Location**

Feature	Points
Size <3 cm	1
3-6 cm	2
>6 cm	3
Location non-eloquent	0
eloquent	1
Venous drainage superficial only	0
deep	1

- Size: <3, 3-6, >6cm
- Eloquence of brain: Yes/No
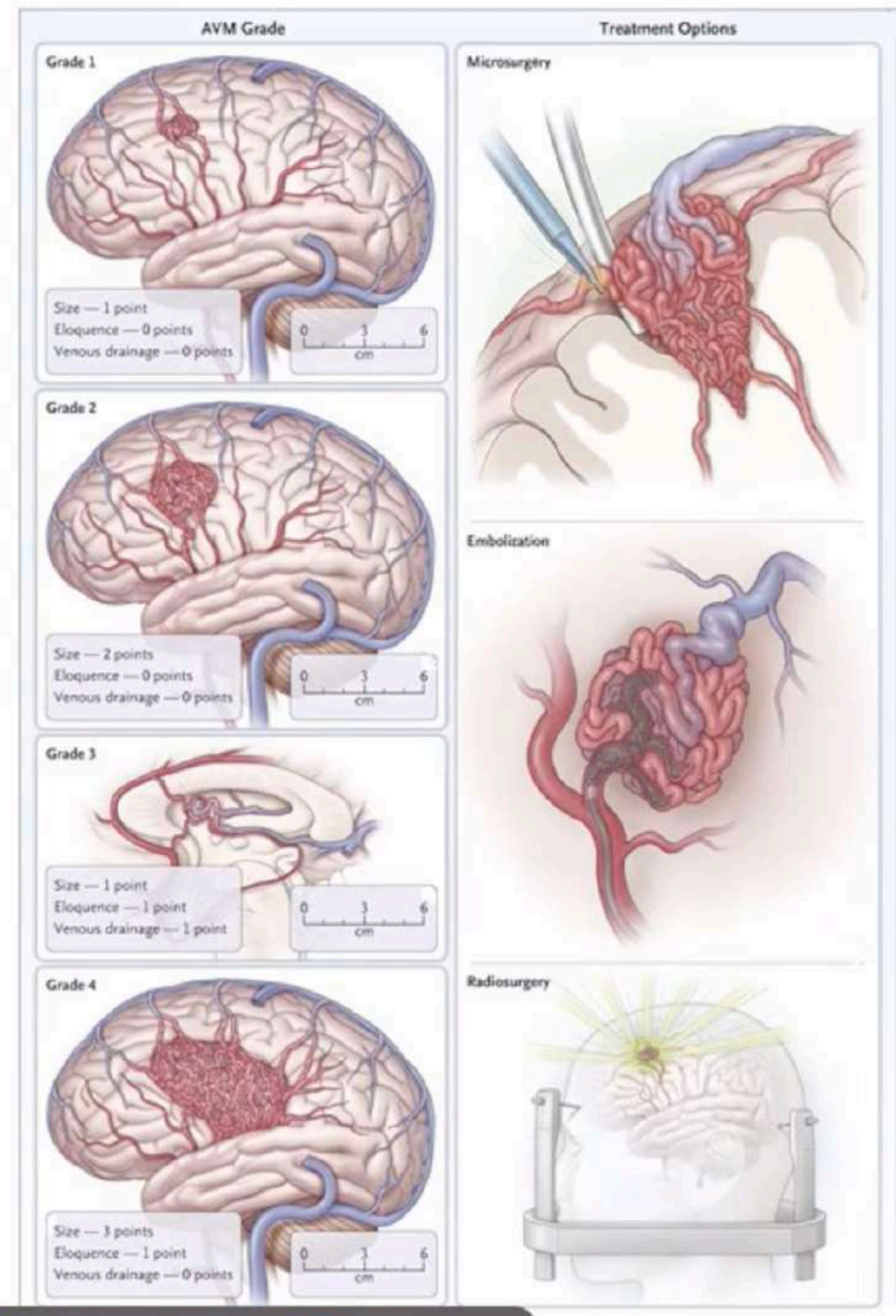- Venous Drainage: Superficial/Deep

SM grade VI: untreatable lesions

Not applicable for pediatric AVM

Most AVM presenting are SM grade III

Management:

- Class A (SM grade I, II): surgical resection

- Class B (SM grade III): multimodality

- Class C (SM grade IV, V): follow up

MANAGEMENT

- Spontaneous ICH → look for AVM (CTA, MRA, DSA)

- ICH management

- Ruptured AVMs
  - Surgical resections – low vs high SM grades

- Unruptured AVMs
  - Debatable

ARUBA trial

Medical management with or without interventional therapy for unruptured brain arteriovenous malformations (ARUBA): a multicentre, non-blinded, randomised trial

Prof J P Mohr, MD * • Prof Michael K Parides, PhD * • Prof Christian Stapf, MD ✉ * • Ellen Moquete, RN

Claudia S Moy, PhD • Jessica R Overbey, MS • et al. Show all authors • Show footnotes

Check for updates

PlumX Metrics

Interpretation

The ARUBA trial showed that medical management alone is superior to medical management with interventional therapy for the prevention of death or stroke in patients with unruptured brain arteriovenous malformations followed up for 33 months. The trial is continuing its observational phase to establish whether the disparities will persist over an additional 5 years of follow-up.

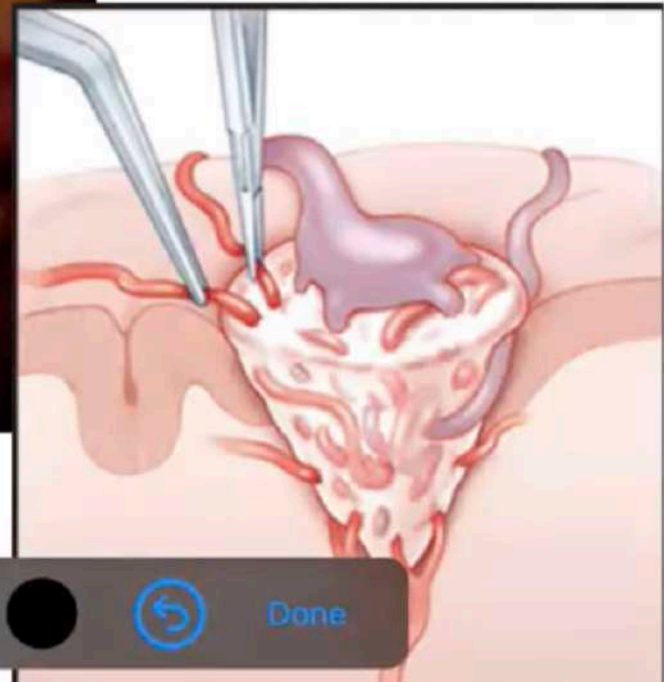# MODALITIES

Surgery
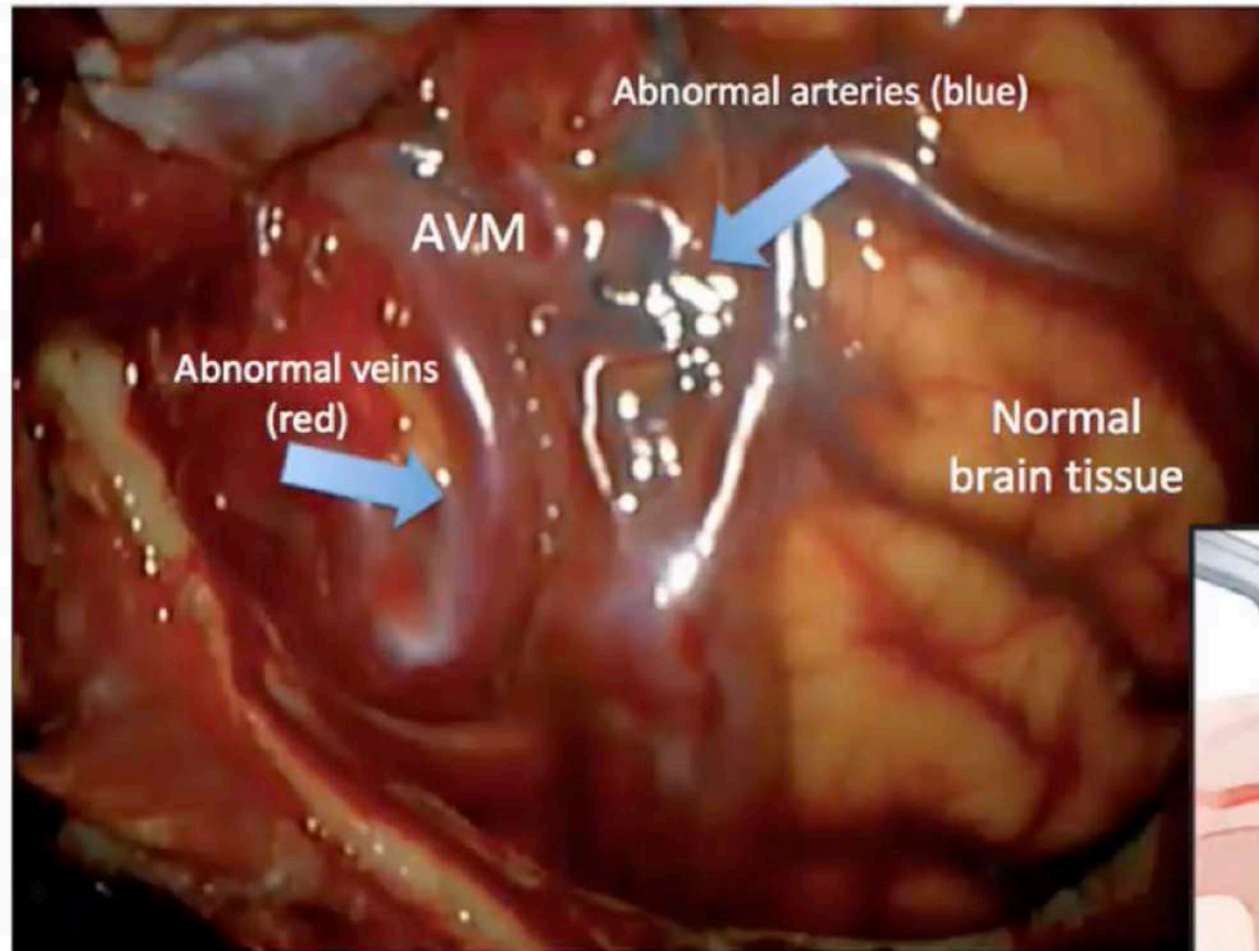- Best for SM grades I-II

Radiation
- SRS for small deep AVMs (<3cm)

Endovascular AVM embolization

Combination

SURGERY

- **pros:**
    - Eliminates bleeding risk immediately
    - Seizure control improves
- **Cons:**
    - Risk of surgery
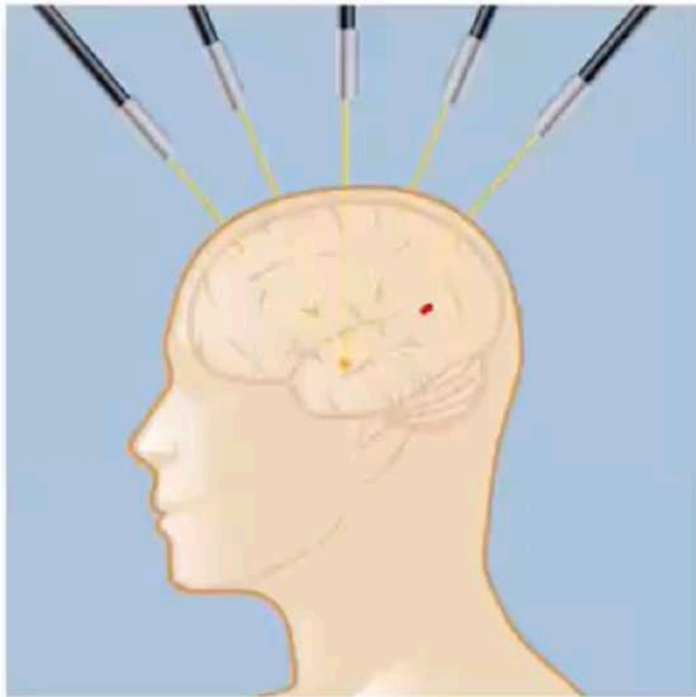- **Suited for:**
    - SM grades I-II
    - SM grades IV-V are at risk of poor outcomes

SRS

Stereotactic
Radiosurgery

Gamma Knife
Cyber Knife

80%

| 1st GKS | Wait 3-4 yrs radiobiological repair | Obliteration | 2nd GKS | Wait 3-4 yrs | Obliteration | Repeat GKS |

Low dose of radiation
Low risk of complication

can deliver a higher dose in 2 stage
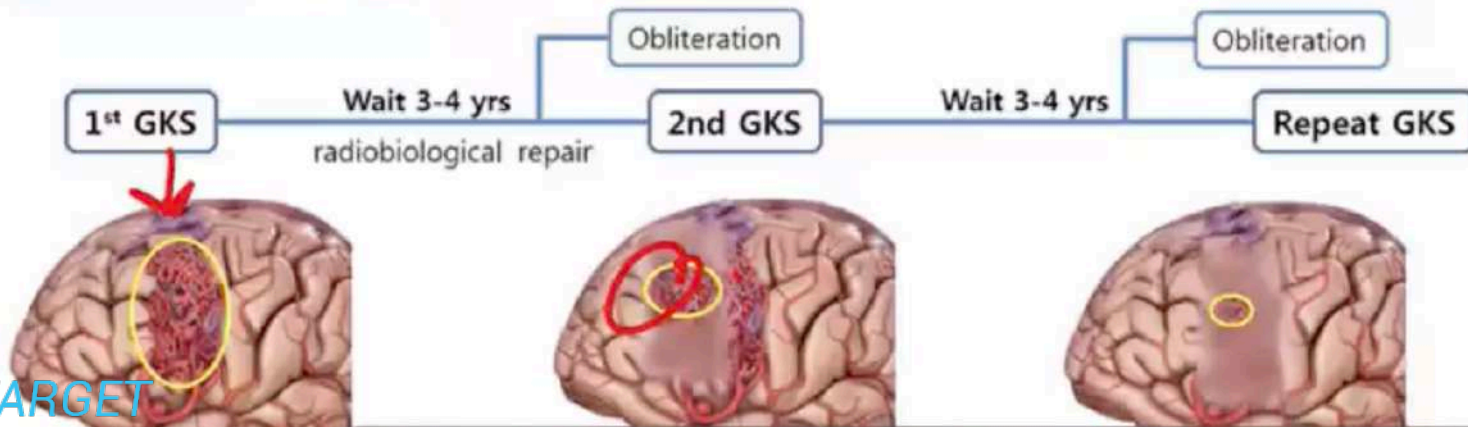
ENDOVASCULAR AVM EMBOLIZATION
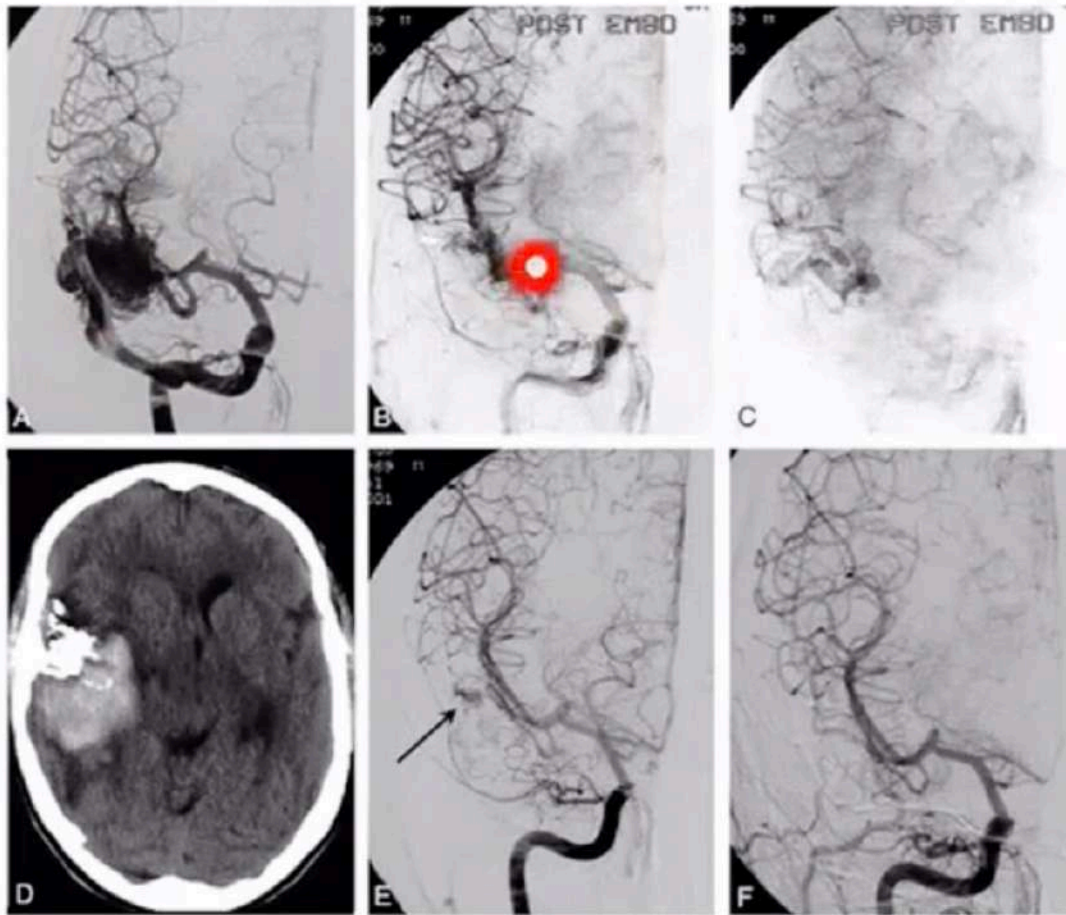
- **Suited for:**
  - High grade AVMs
  - Palliative symptoms
- **Pros:**
  - Facilitates surger / SRS
- **Cons**
  - Inadequate sometimes to obliterate
  - Multiple procedures

COMPLICATIONS

Normal perfusion pressure breakthrough

Occlusive hyperemia

Re-bleeding

seizures

FOLLOW-UP

Following surgery

- IO/Post op DSA
- Residual AVM treated in same sitting
- f/up at 1 year and 5 years

Following SRS

- MRI/MRA 6 monthly → DSA to confirm obliteration
- Long term MRI/CT

KEY POINTS

- Dilated vessels are dysplastic
- No capillary bed / intervening parenchyma in the nidus
- AVMs are high-flow & medium-high pressure
- Usually present with hemorrhage, less often seizures
- First hemorrhage risk – 1%/year
- Recurrent hemorrhage risk – 5%/year
- Increasing age, deep venous drainage, aneurysms, female → higher risk

- First seizure risk → 8% / 5 years
- Epilepsy risk after 1st seizure → 58%

- Surgery → curative
- SRS → obliterates 70-80% AVMs over 3 years, reserved for <3cm lesions
- Endovascular embolisation → adjunt to surgery / SRS, for high risk entities and palliate high-flow symptoms

SOME MCQS

1 the most common vascular malformation is

A venous angioma B AVM

C cavernous angioma D Capillary telangiectasia

2 the characteristic "pop corn" appearance seen on T2WI MRI is seen in

A AVM

B cavernous angioma

C capillary telangiectasia

D venous angioma

3 "medusa head" appearance on cerebral angiogram is seen in

A AVM
B cavernous angioma
C capillary telangiectasia
D venous angioma

4 the most common artery involved in AVM are

A ACA and frontal lobe   B PCA and occipital lobe

C **MCA and parietal lobe**   D MCA and temporal lobe

5 posterior fossa AVM account for what percentage of pial AVMs

A   4%   B   8%

C   **15%**   D   24%

6 Hemangioma Calcificans is term used for

A   venous angioma   B Capillary telangiectasia

C   **cavernous angioma**   D AVM