

Vascular malformations of CNS

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Graduate course for neurosurgery

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Importance

- Stroke is the most frequent manifestation of cerebrovascular disorders (szélütés, Hirnschlag, stroke)



Cerebrovascular diseases (CBVD) are conditions that develop as a result of problems with the blood vessels inside the brain

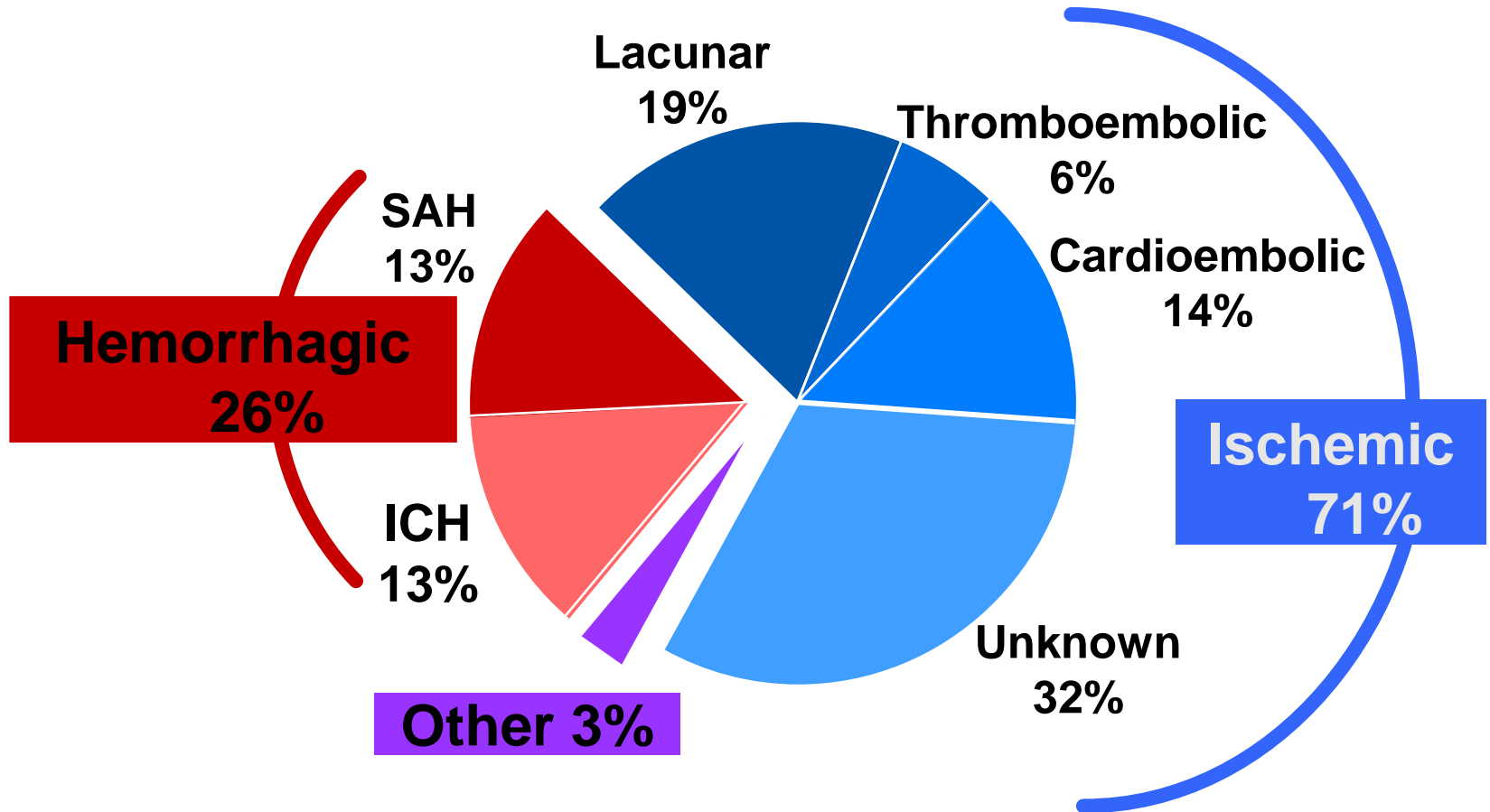
stroke – a serious medical condition where the blood supply to the brain is disturbed

Hans Mielich
IV. Wilhelm Duke of Bavaria
Dying after suffering a stroke
1550
München, Bavarian National Museum

Clinical manifestations

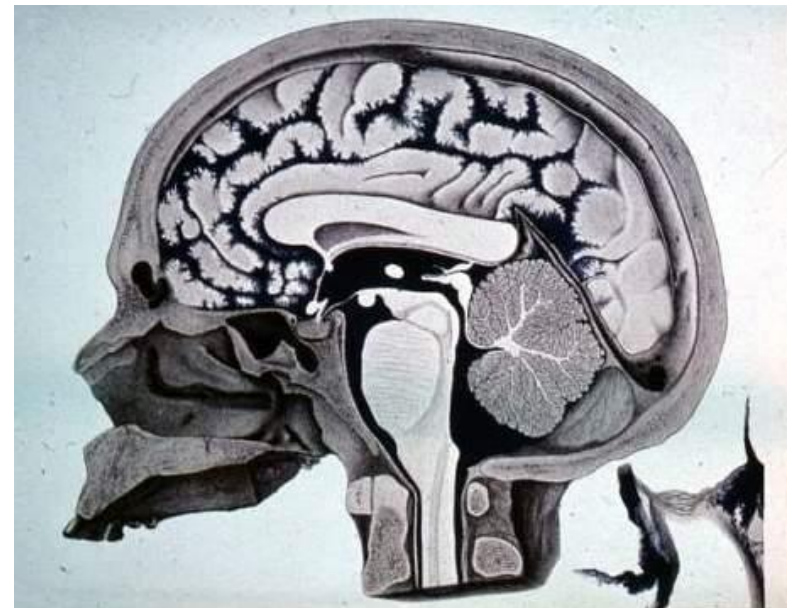
- Ischemic stroke
- Subarachnoidal hemorrhage (aneurysm rupture)
- Arteriovenous malformations
 - Angiomas
 - Cavernomas (cavernous hemangiomas)
 - Dural A-V fistulae
 - Carotideo-cavernous fistulae
- Intracerebral hematomas

Epidemiology – different stroke types



Symptoms of intracranial bleeding

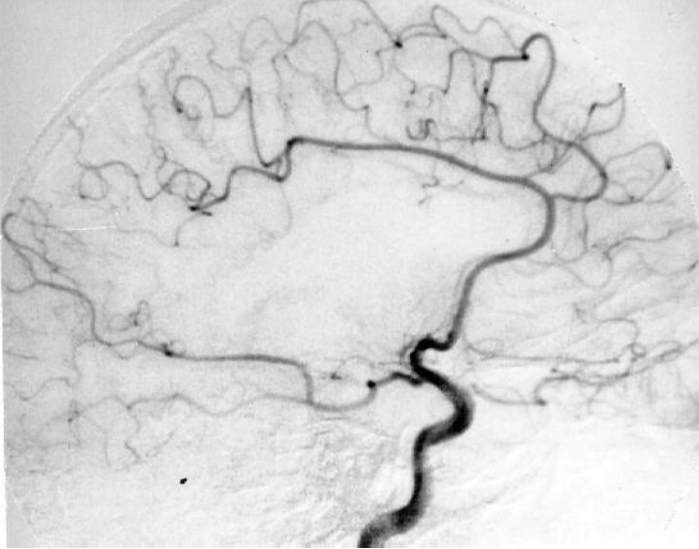
- Subarachnoidal hemorrhage
 - Sudden onset (ictus cerebri)
 - Headache, nausea, vomiting, dizziness
 - Loss of consciousness (LOC)
 - Focal signs
- Intracerebral hemorrhage
 - Focal signs
 - Consciousness maintained



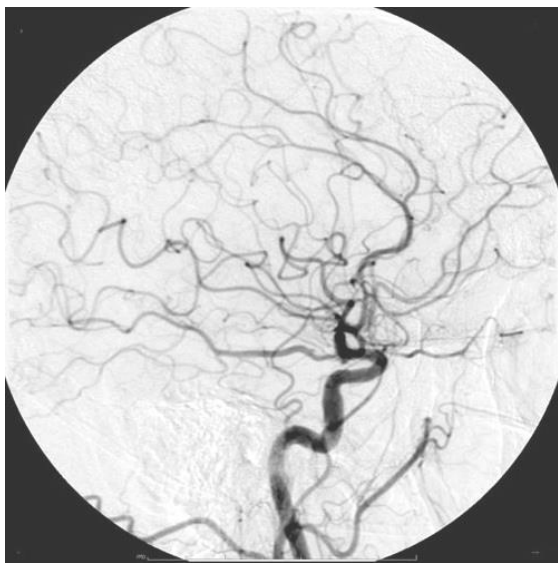
Subarachnoidal spaces from Key and Retzius

Ischemic stroke

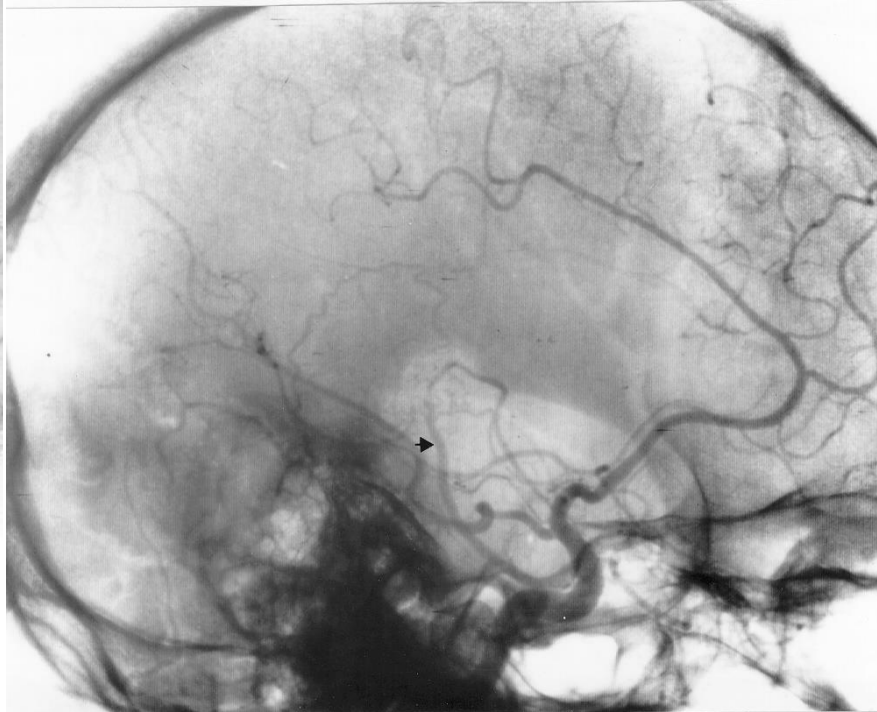
- Manifestation: TIA, PRIND, progressing, completed stroke
- Etiology: thrombosis, embolization
 - Moya-moya
- **Surgical treatment – revascularisation**
 - Goal of treatment: prevent further strokes
 - EIAB (STA-MCA anastomosis)
 - EDAS (Enkephalo – Duro – Arterio – Synangiosis)
- EC-IC Bypass Cooperative Study (1987)



Total occlusion of right MCA



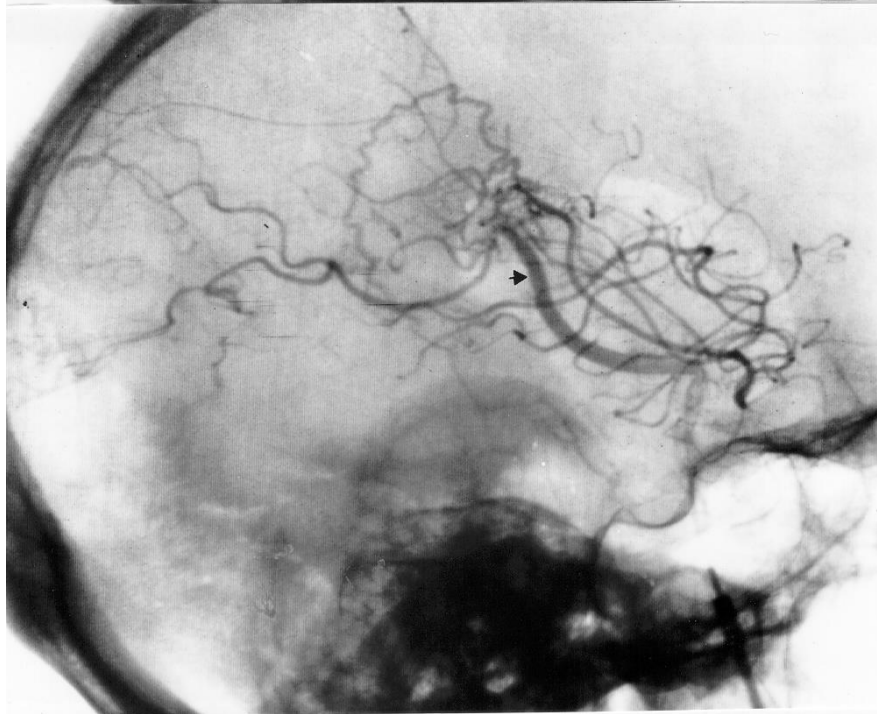
Normal AG lateral view



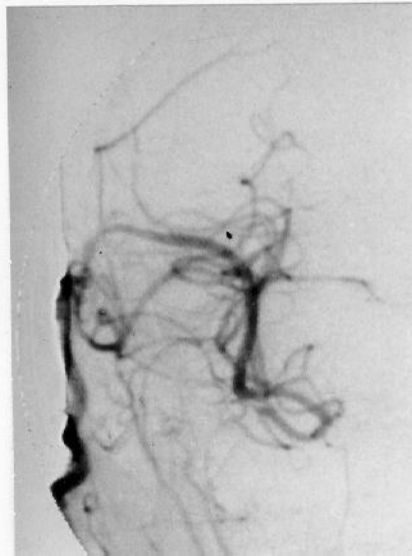
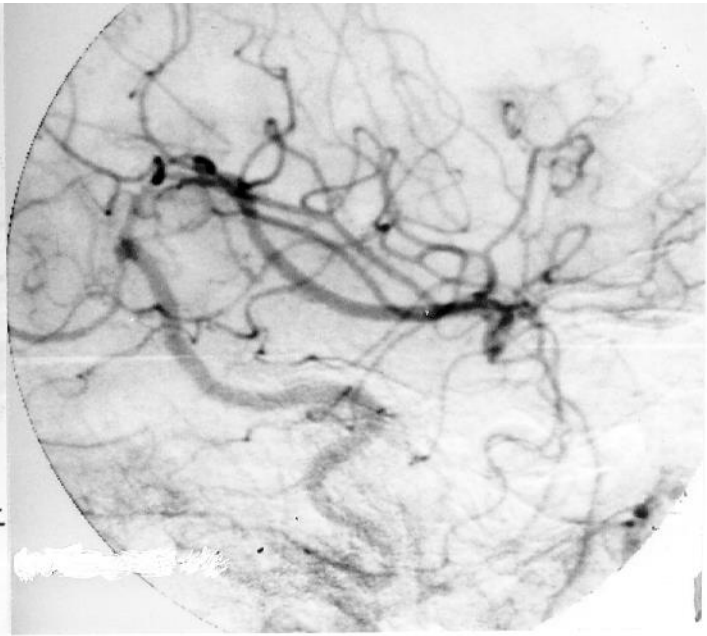
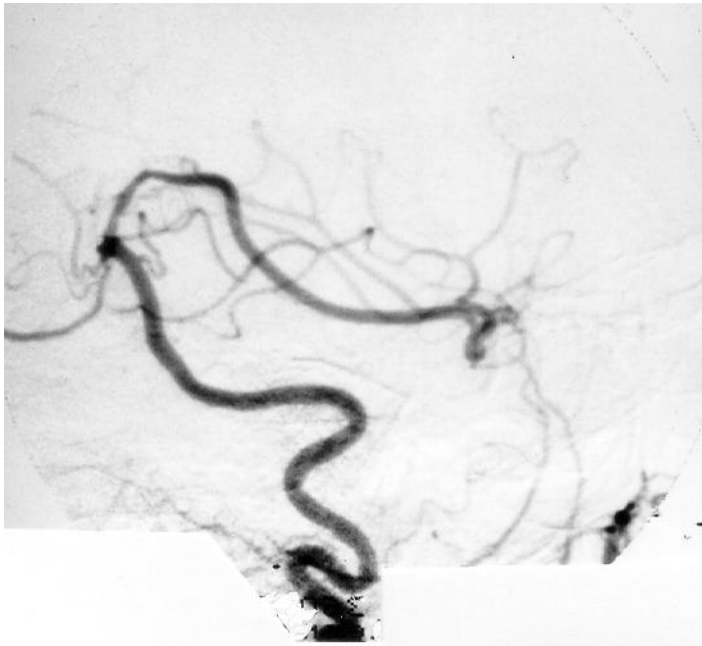
Control AG after EC-IC bypass surgery

Arrow points to the Anastomosing STA branch

At 3 months the anastomosis is patent, fills only one MCA branch

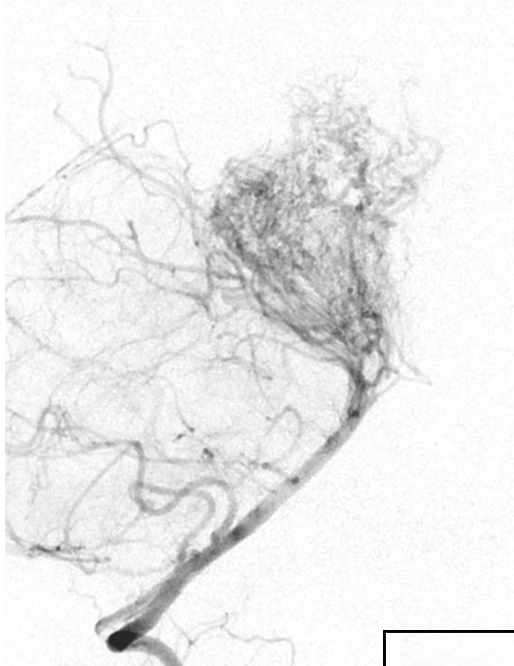


After 1 y dilated STA branch retrograde fills the entire MCA system



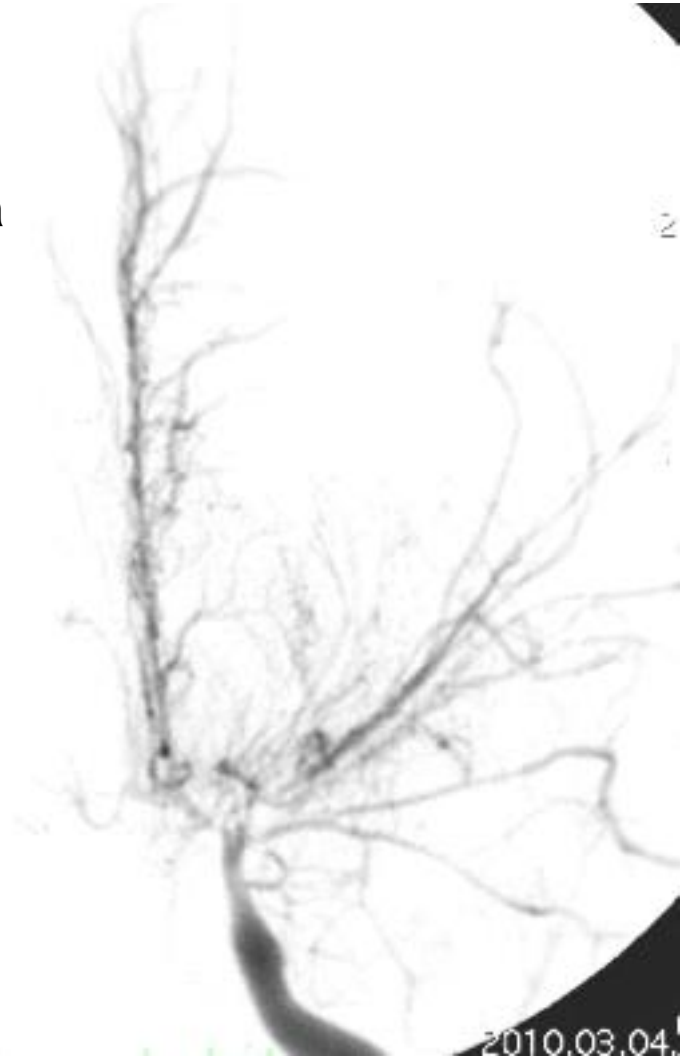
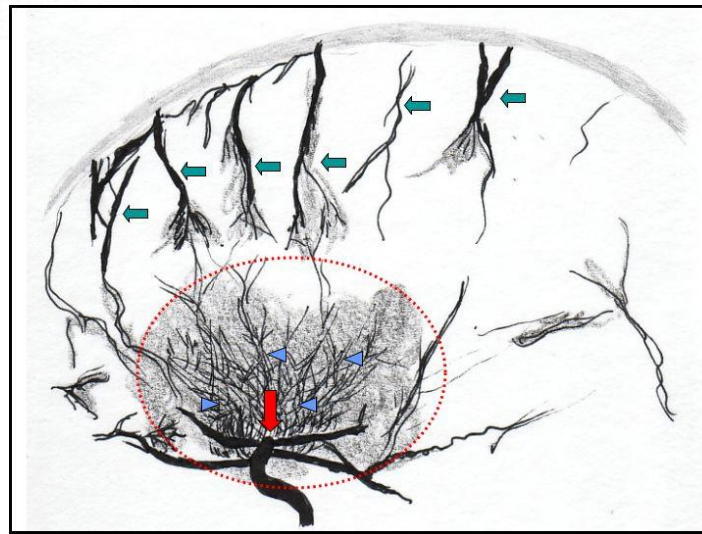
Same as previous on enlarged images

Moya-moya

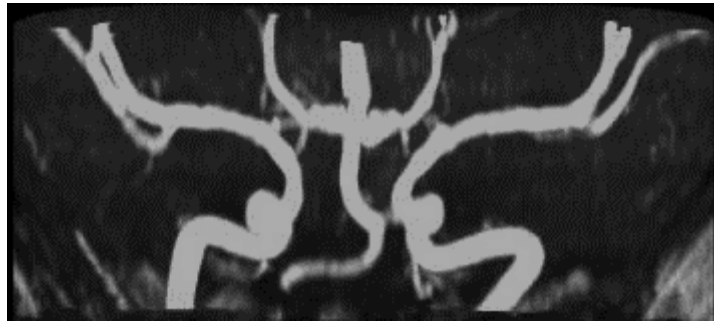


9 y girl, bilateral moyamoya

„puff of smoke”



14yM – progressing bilateral occlusion of ICA bifurcation



2013



2015

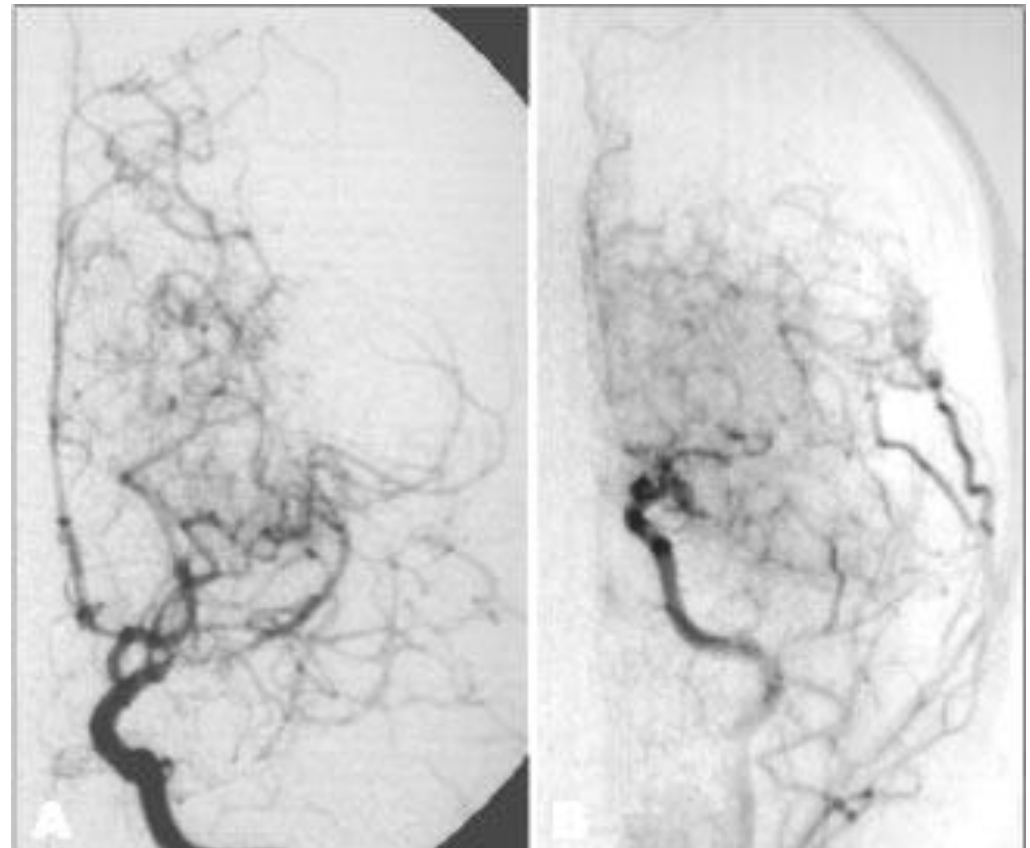


2019

Moya-moya – surgical treatment

Adults: anastomosis

Child: EDAS



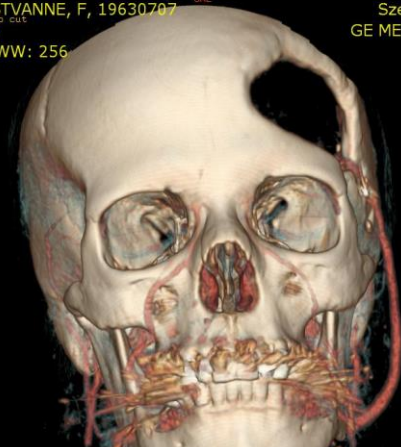
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2407, 20090316
Fr: 9. WL: 127, WW: 256

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2407, 20090316
GE MEDICAL SYSTEMS

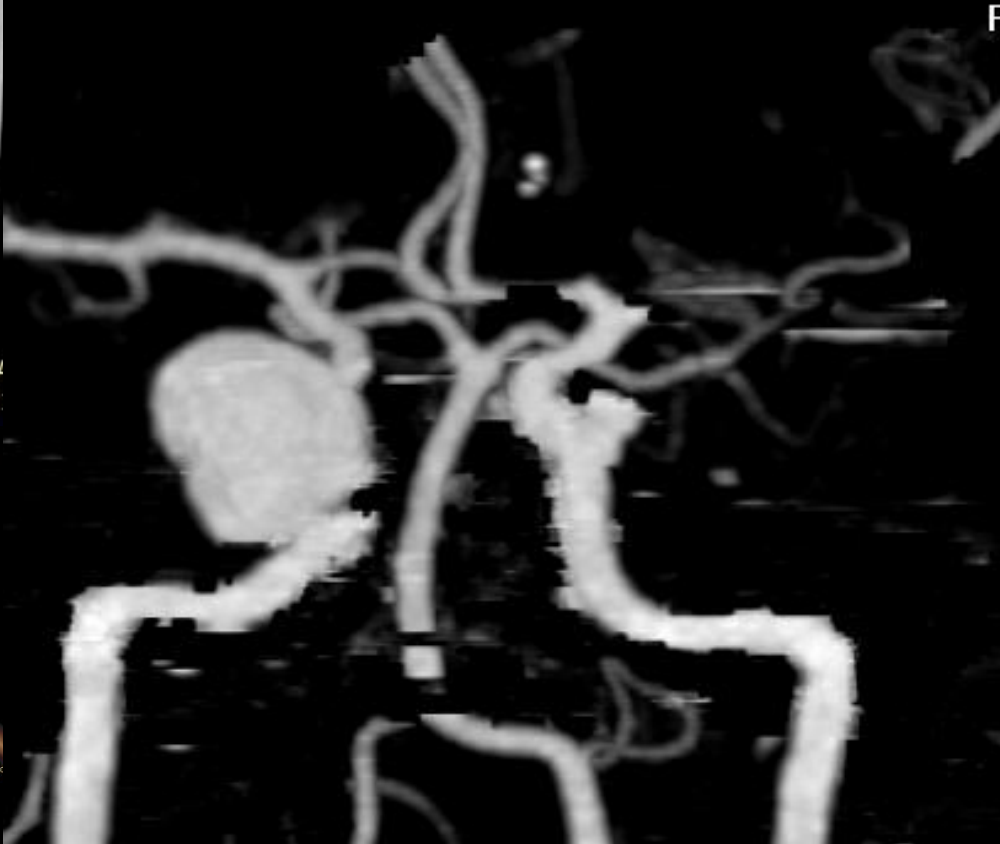


WL: 150 WW: 800 [D]
T: 5.0mm L: -43.1mm*

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2022. 04. 08. 2



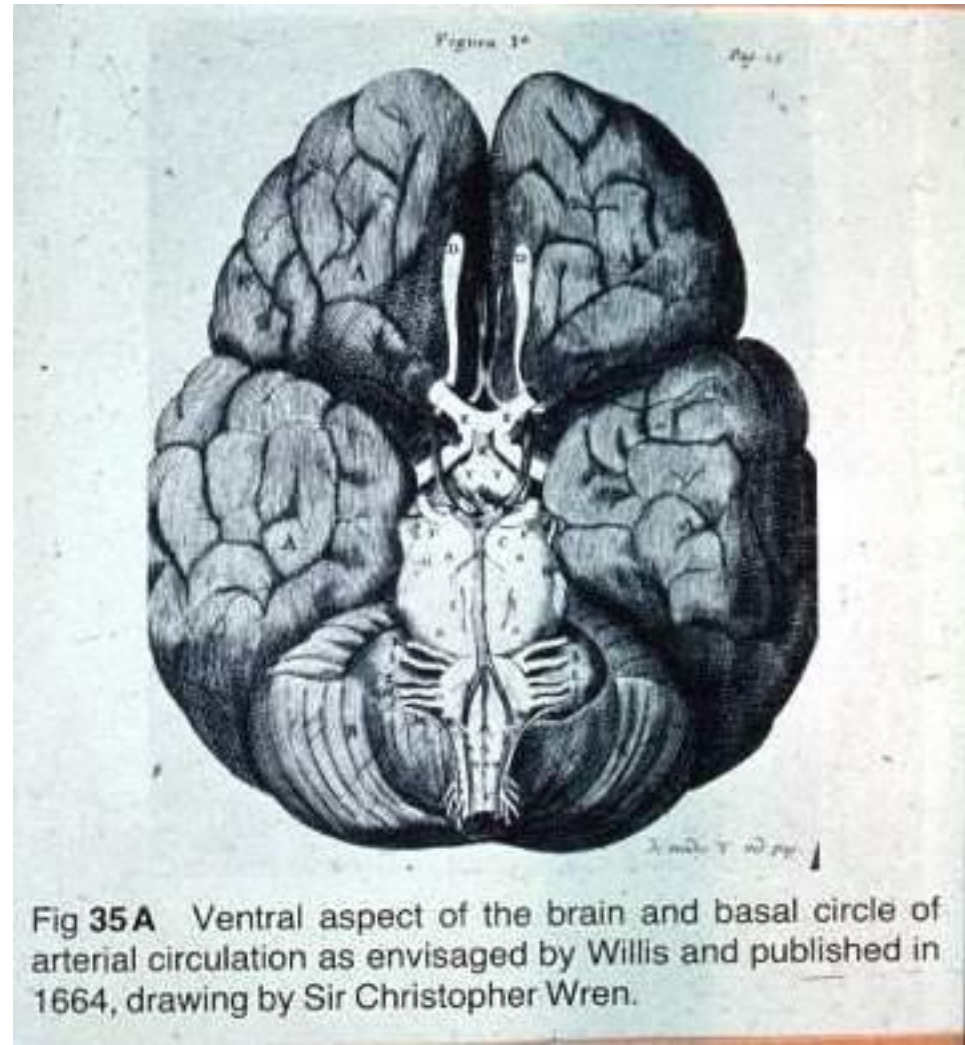
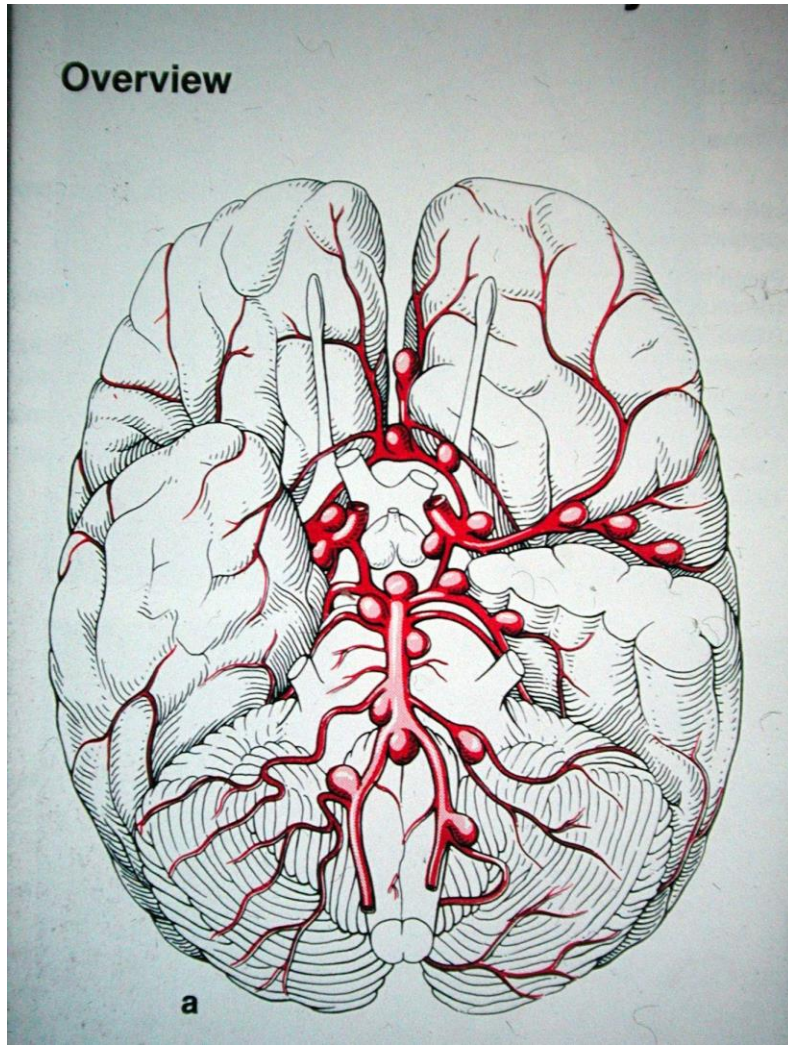
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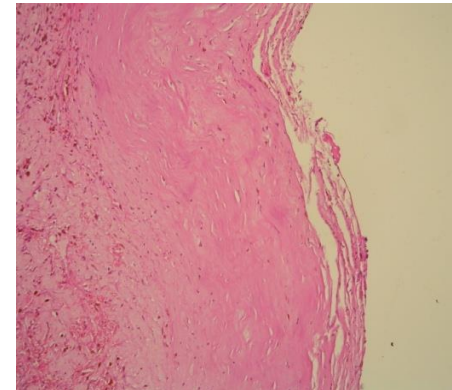
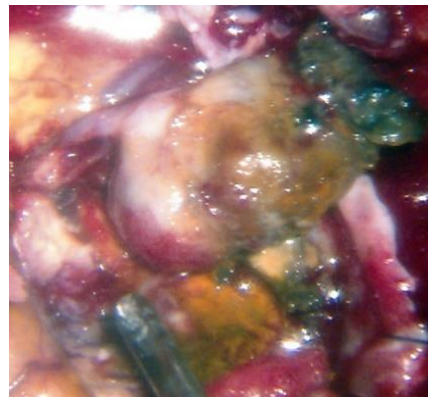
Subarachnoidal hemorrhage-aneurysms

- Incidence: 6-16/y/100000 population
 - Risk factors: age, gender, smoking, untreated hypertension
- Unraptured aneurysm
 - Probability of rupture 1-2%/year
 - Depends on the size of aneurysm

Incidence of aneurysms –according to localization



Unique case of distal (M4) saccular aneurysm



Treatment of aneurysms

- Rule of thumb: the aneurysm must be excluded from the circulation
 - Evolution of the concept
- Direct clipping
 - Safely prevents re-bleeding (long-term experience)
 - Higher treatment risk
- Endovascular obliteration (coiling)
 - Long-term experience is less
 - Low treatment risk
- Vasospasm

Surgical treatment of aneurysms - microsurgery

- Surgery by using the microscope
 - Specialized operating microscopes
- Concept of minimally invasive surgery
 - Surgical anatomy
 - Microtechniques
 - Development of highly specialized tools
- State of the art neuranesthesia

Surgical treatment of aneurysms

Microsurgical exploration

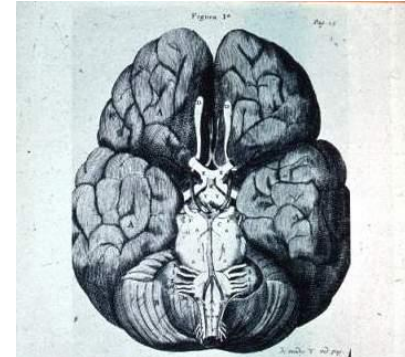
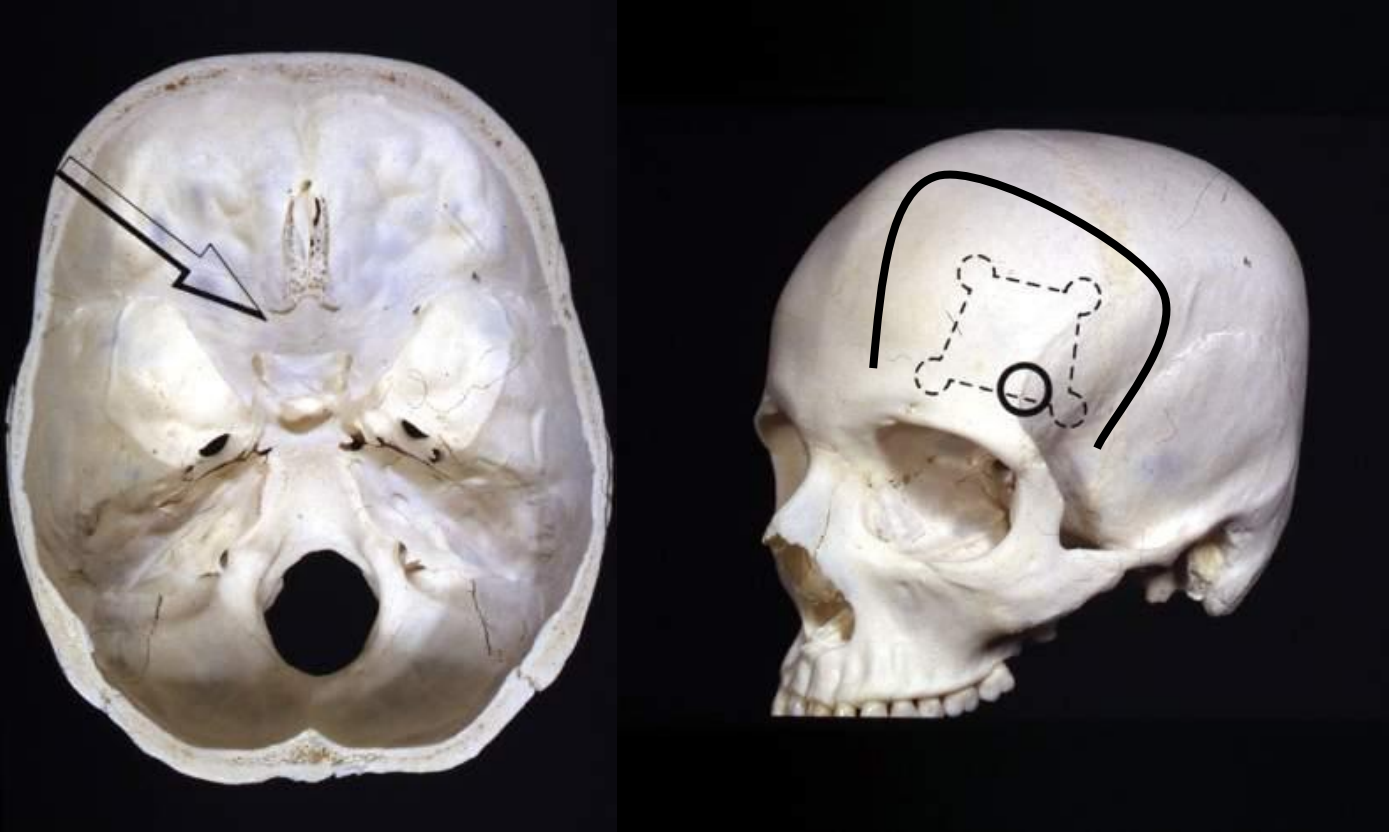
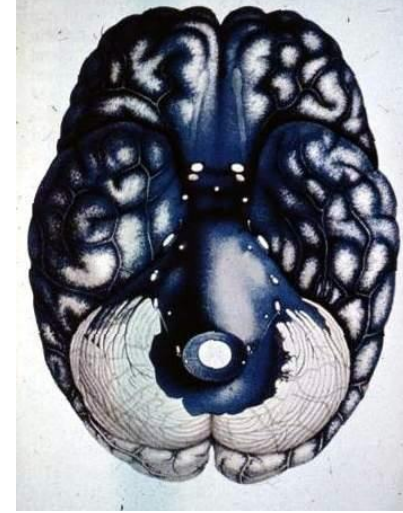


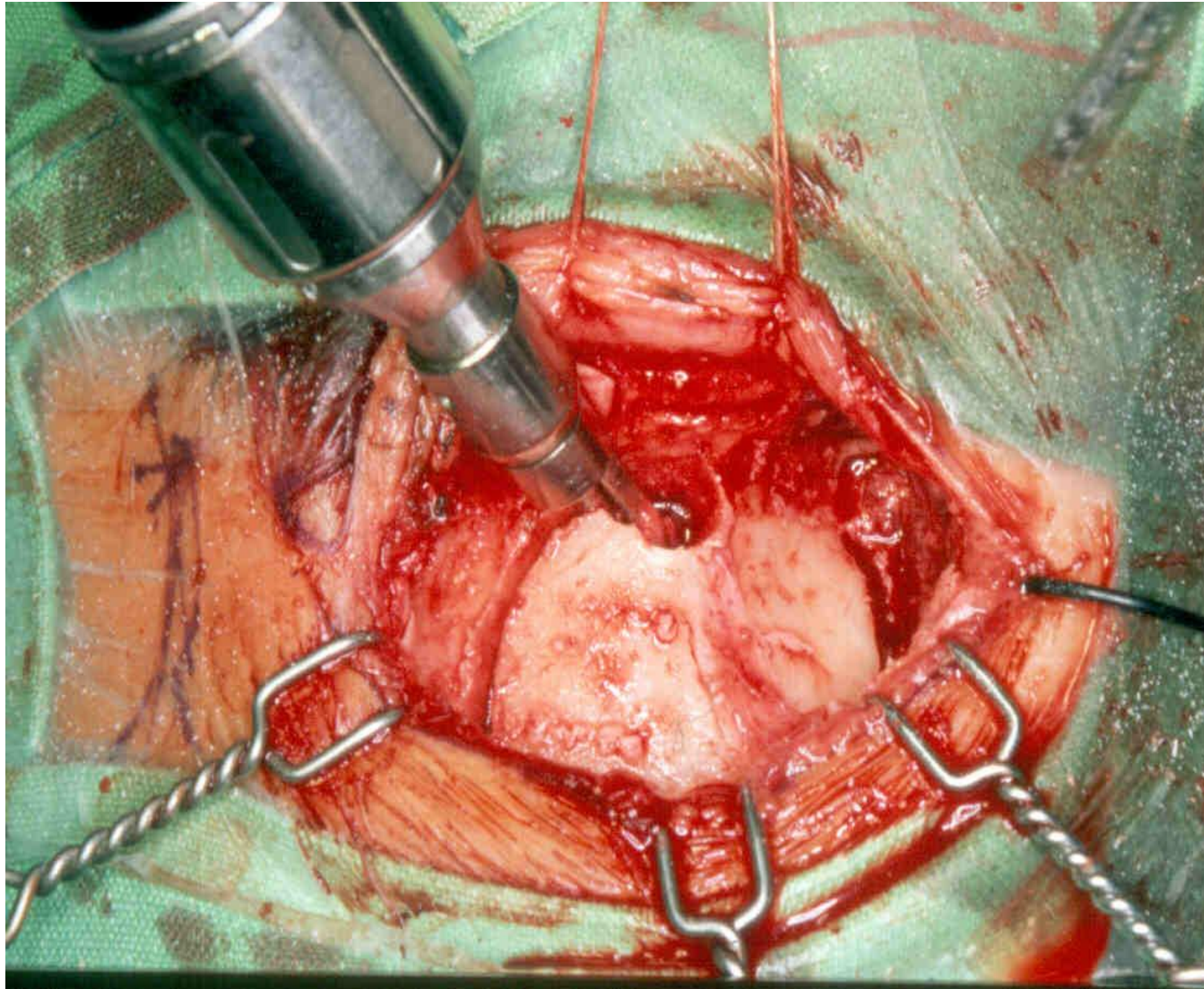
Fig 35A Ventral aspect of the brain and basal circle of arterial circulation as envisaged by Willis and published in 1664, drawing by Sir Christopher Wren.



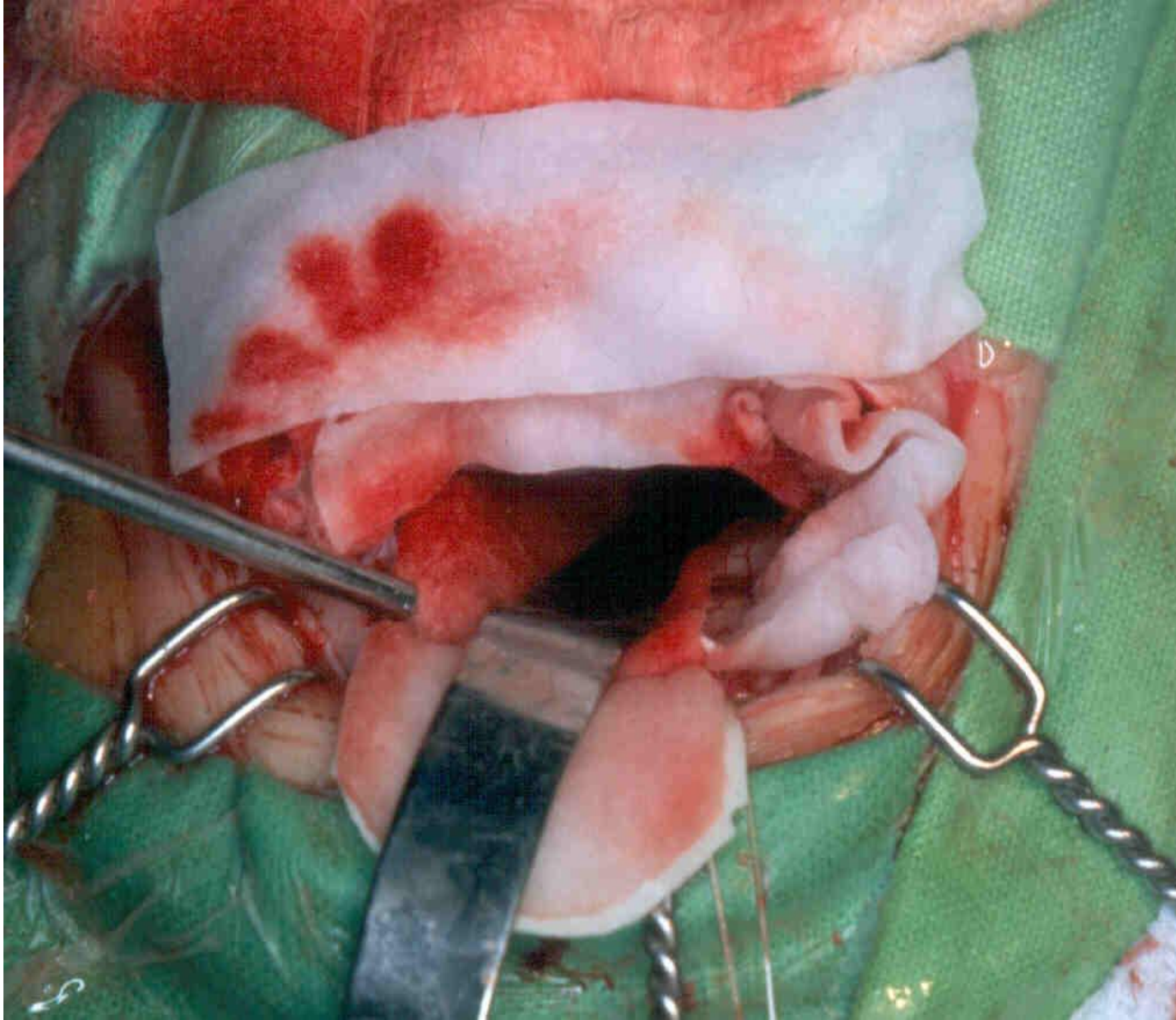
Supraorbital (superciliar) skin-incision



Small (keyhole) craniotomy



Dural exposure



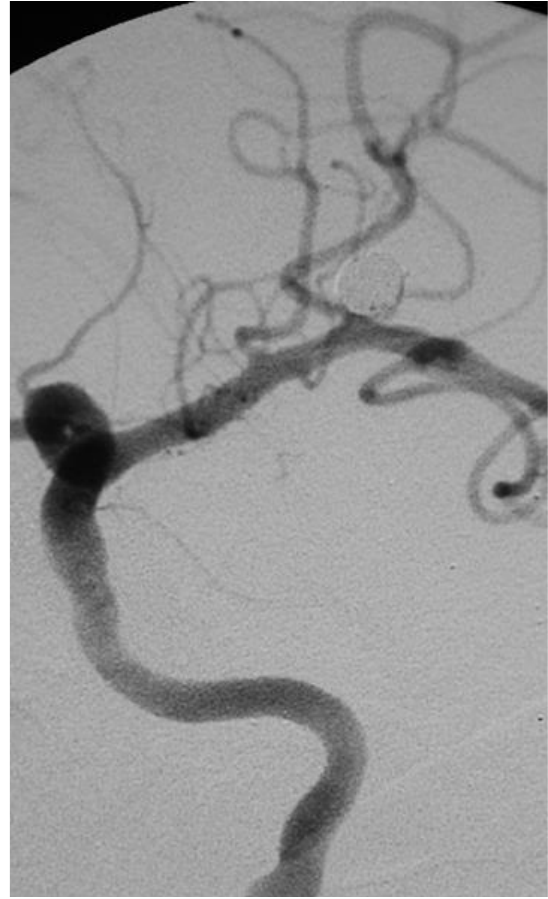
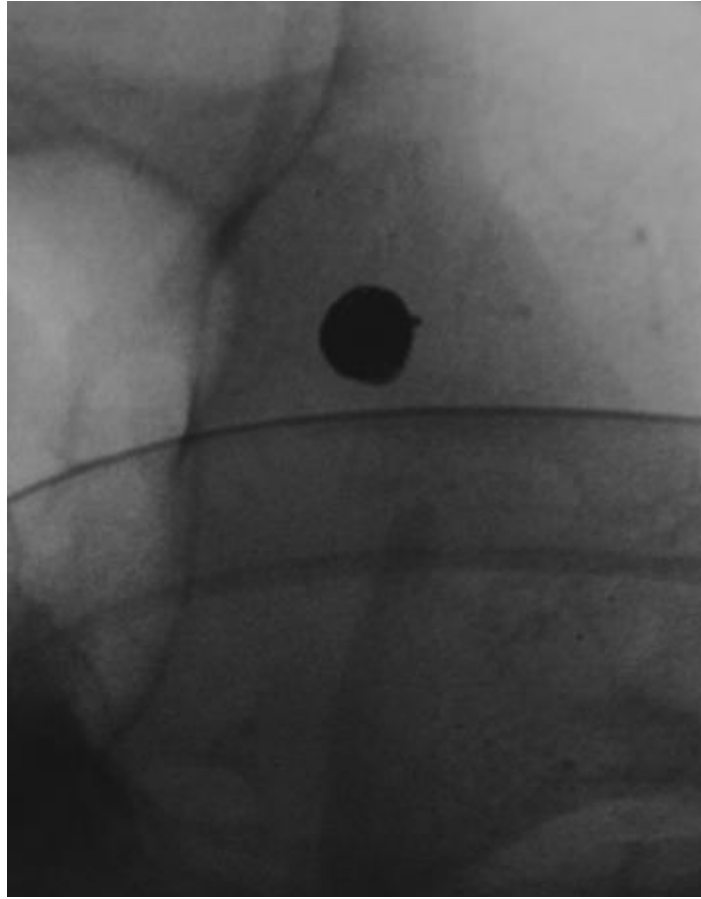
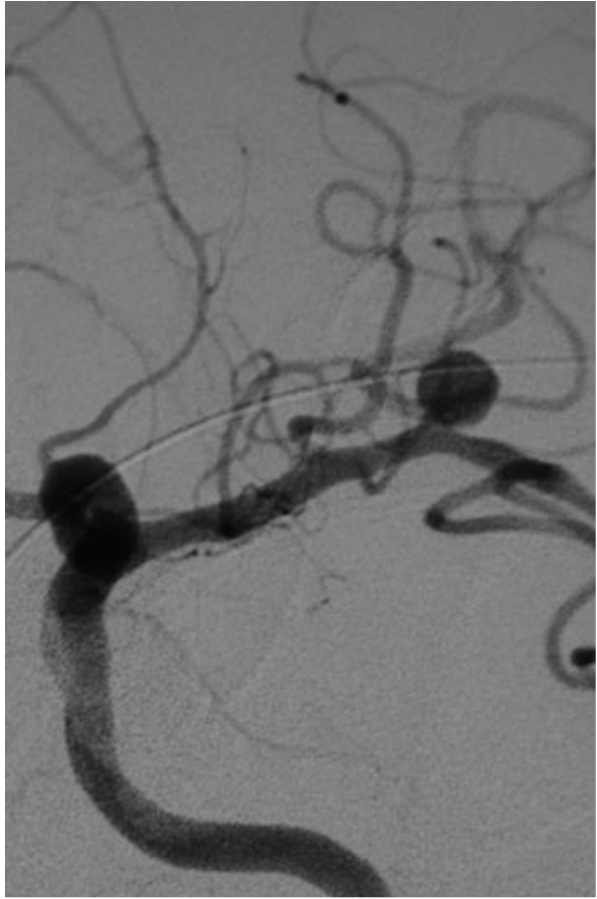
3 months after surgery

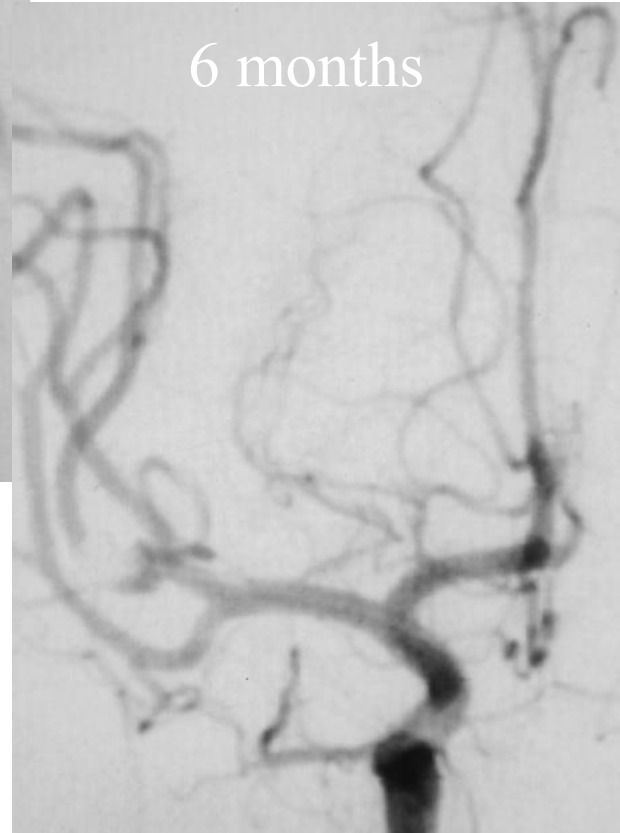
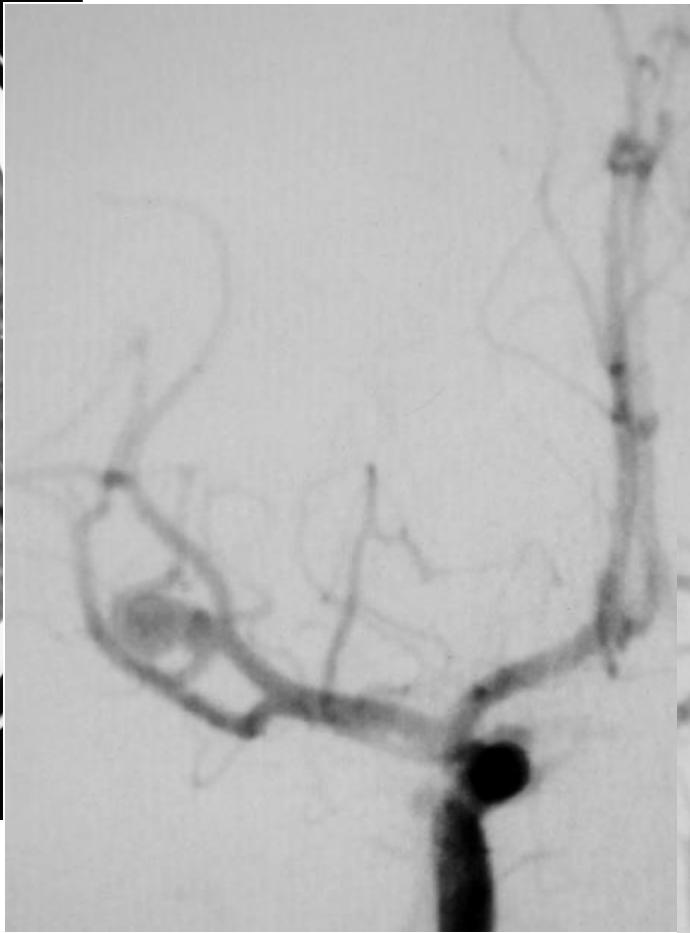




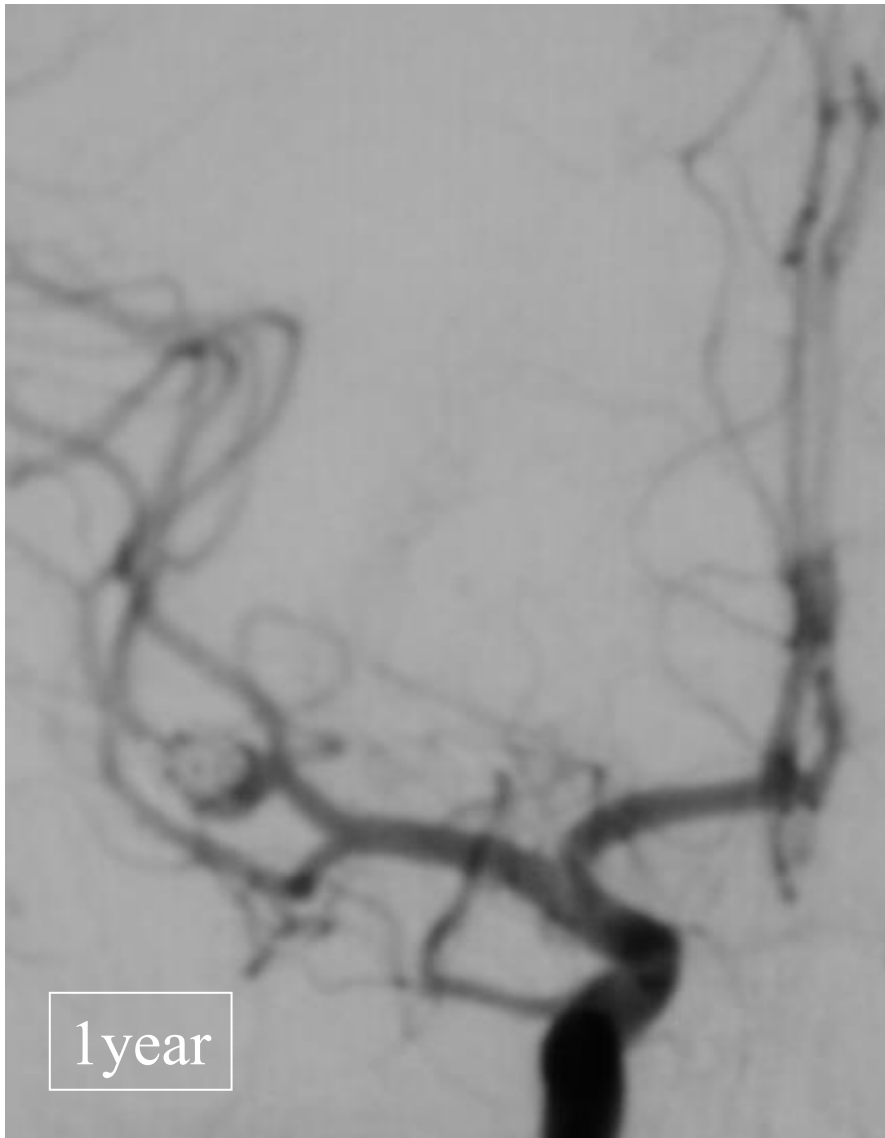
Aneurysm obliteration with microcoils







Case #6 43F HH3



1 year



2 years



52M

Fusiform vertebral artery aneurysm, also causing
SAH

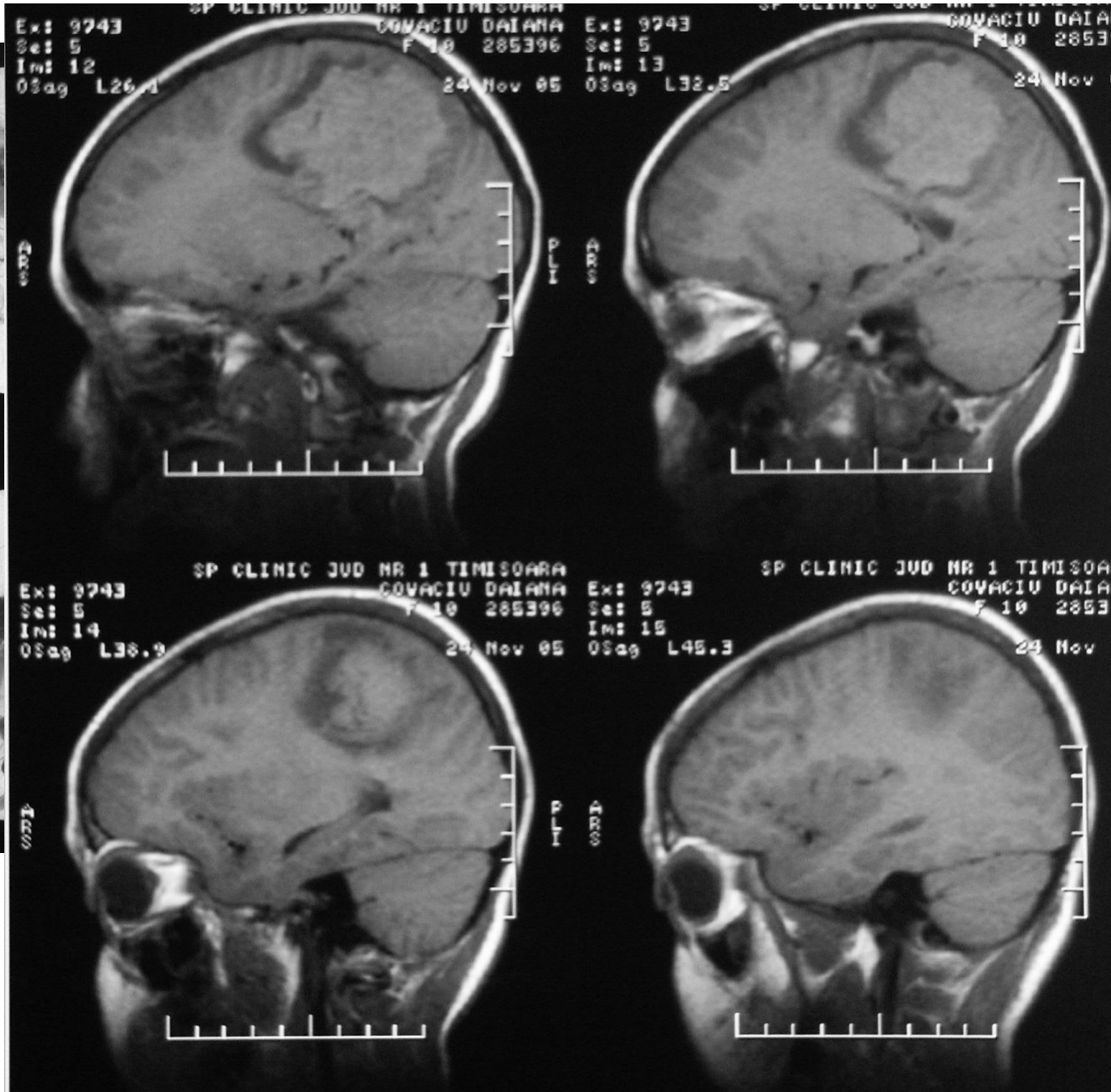
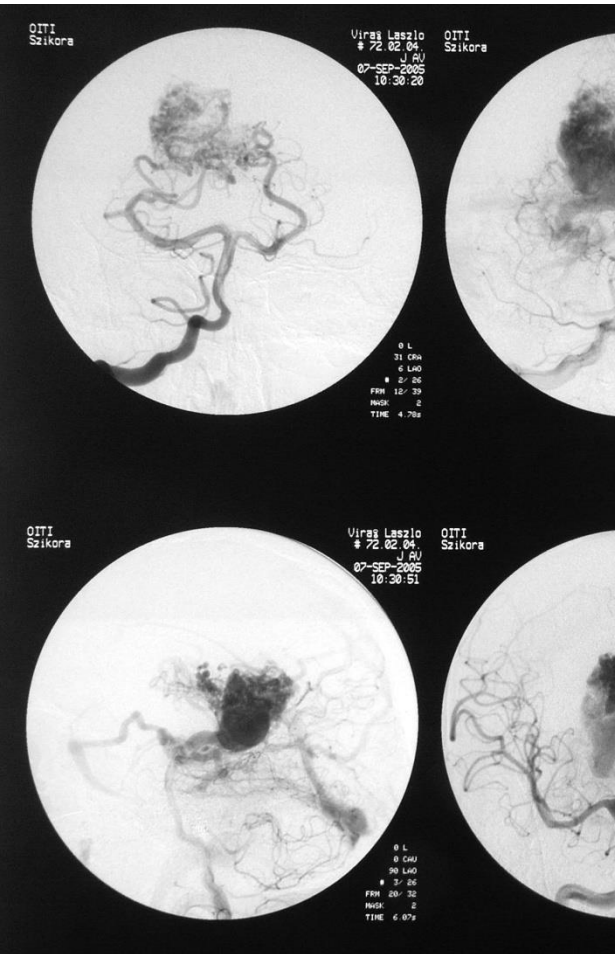
Angiomas

high flow A-V malformations

- Treatment: combined, multimodal
 1. Endovascular embolisation
 2. Resection of residuals either by surgery
or
 1. radiosurgery (small, compact, non-bleeding angiomas)

Results are excellent, low mortality and morbidity – as compared to previous results

Angiomas



Cavernomas

low flow A-V malformations

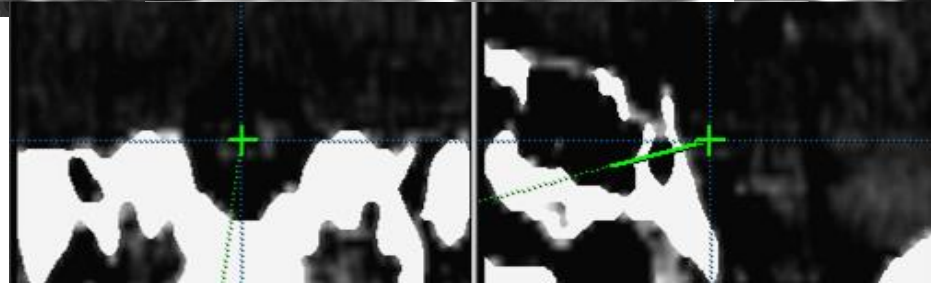
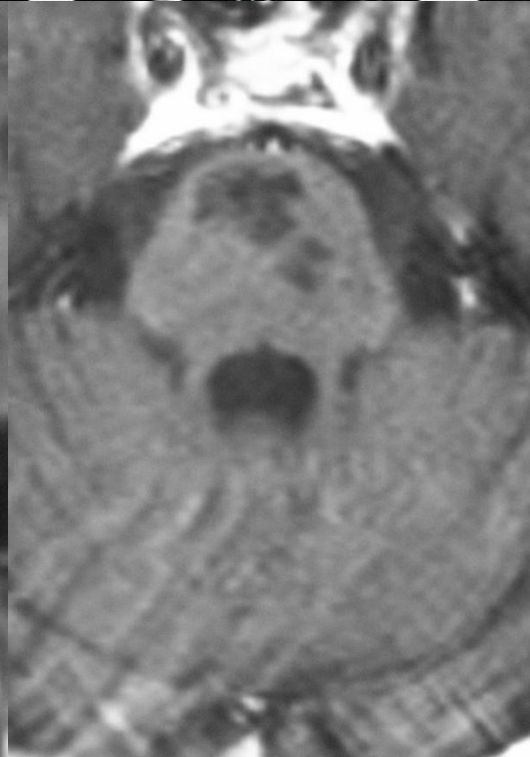
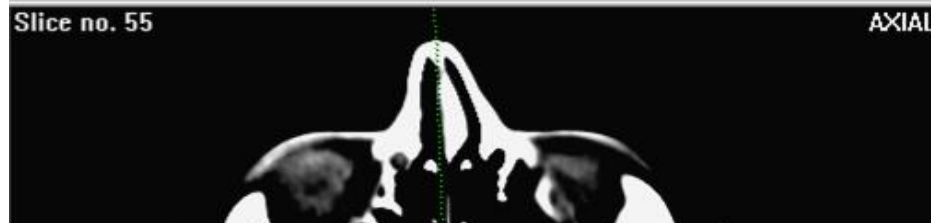
- Anywhere may occur in the CNS – even multiple
- Its more prone to bleeding
 - Bernoulli's law
- Cavernomas causing bleeding need surgical resection
 - Localization can be a challenge

21y F



Cavernoma in the pons

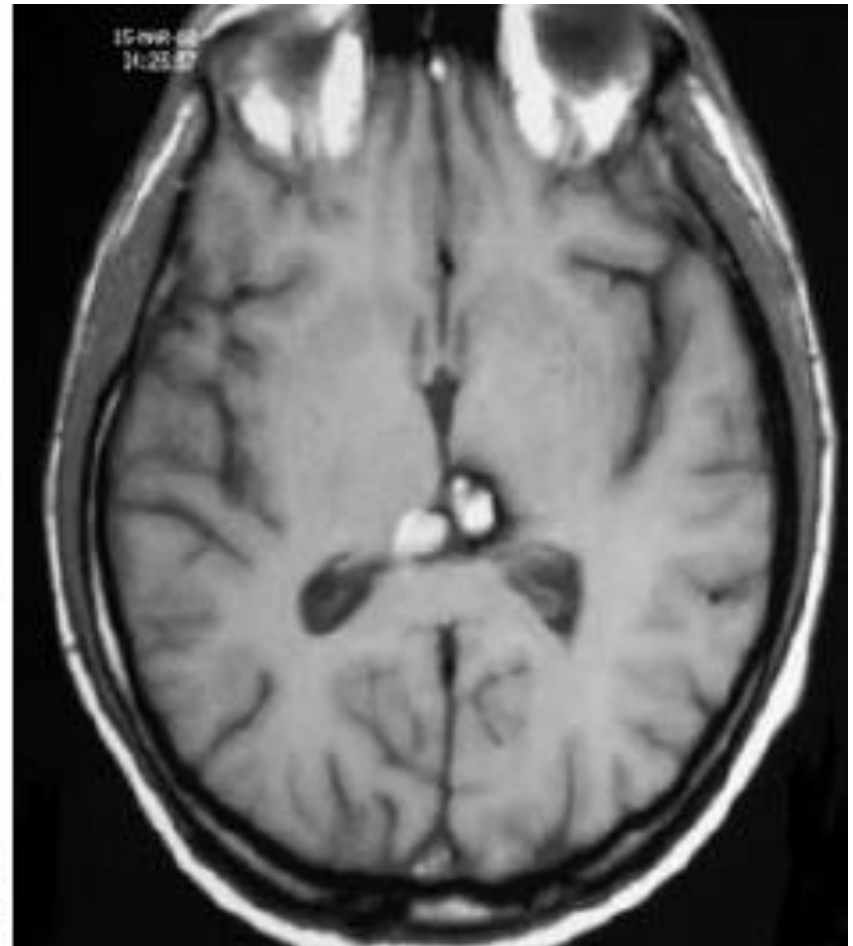
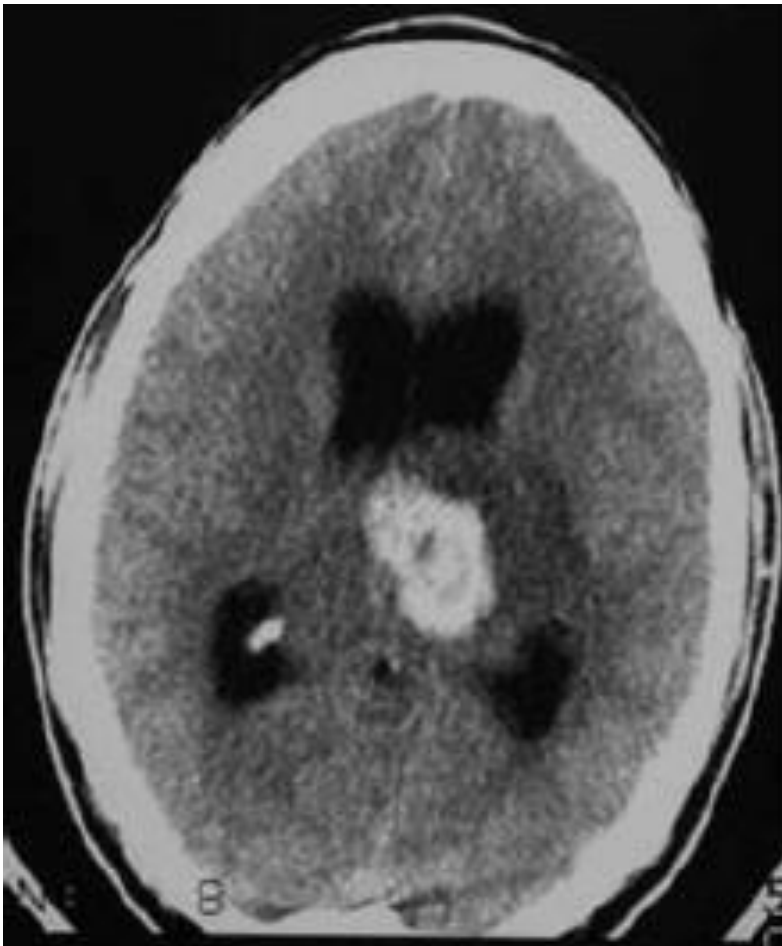
31F



Interesting case

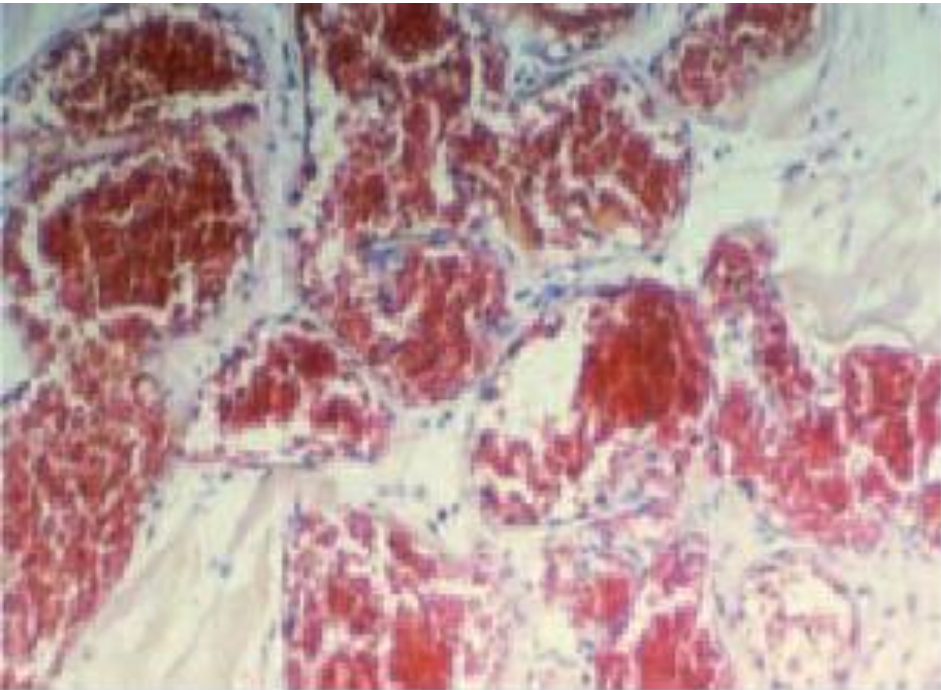
(cavernoma considered and treated as tumor)

26M

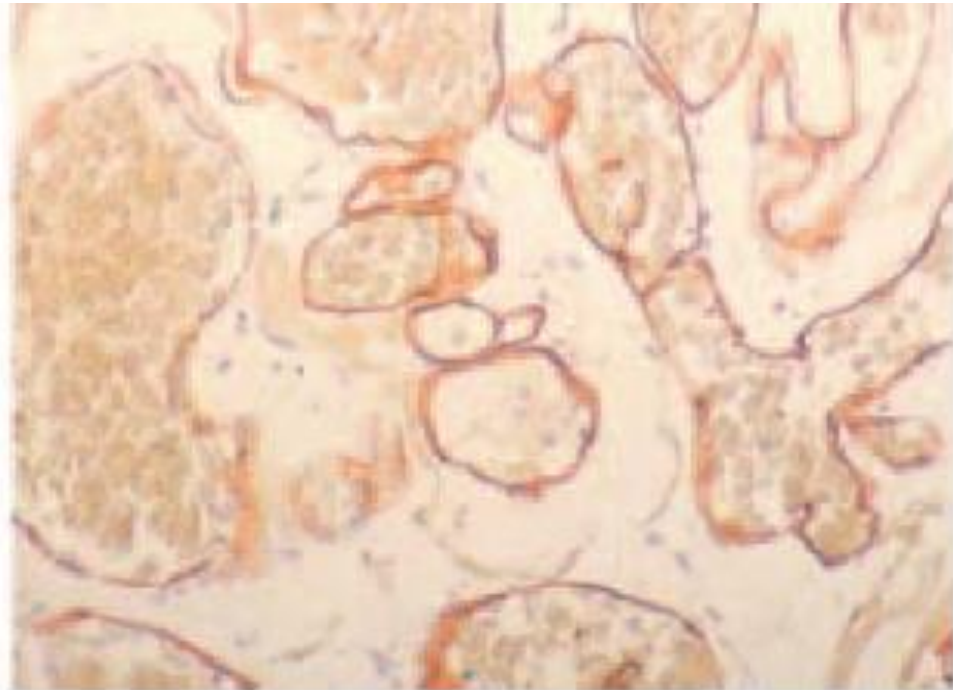


Histology

Histology of a normal cavernoma



HE x 200

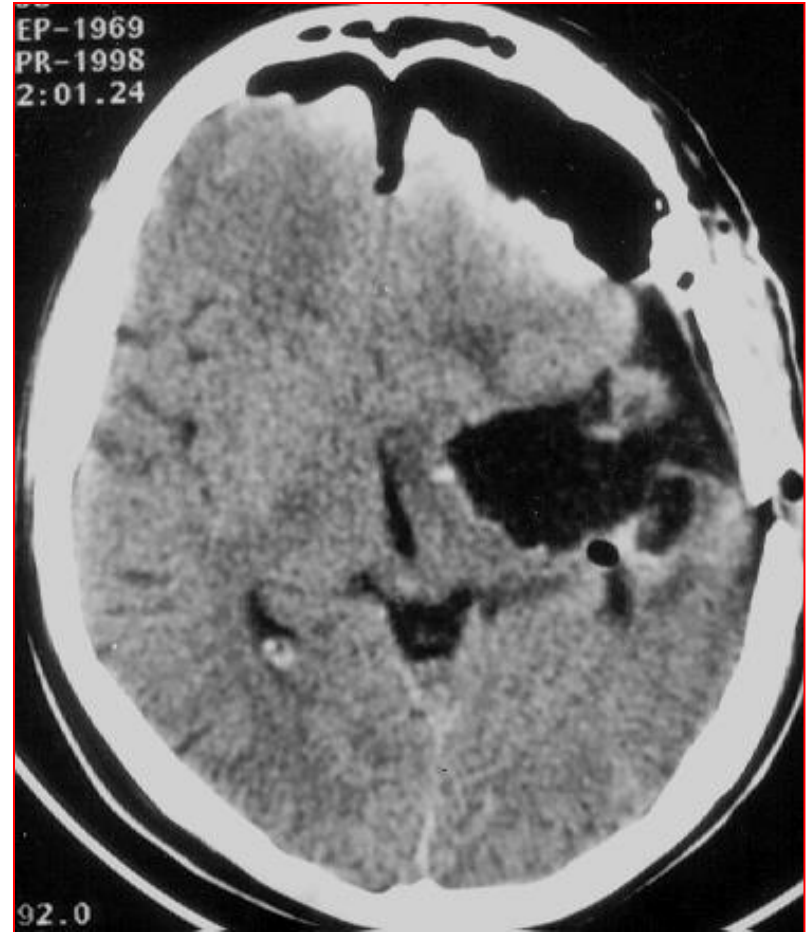


CD34 x 200

Temporo-medial cavernoma; F29y



preop



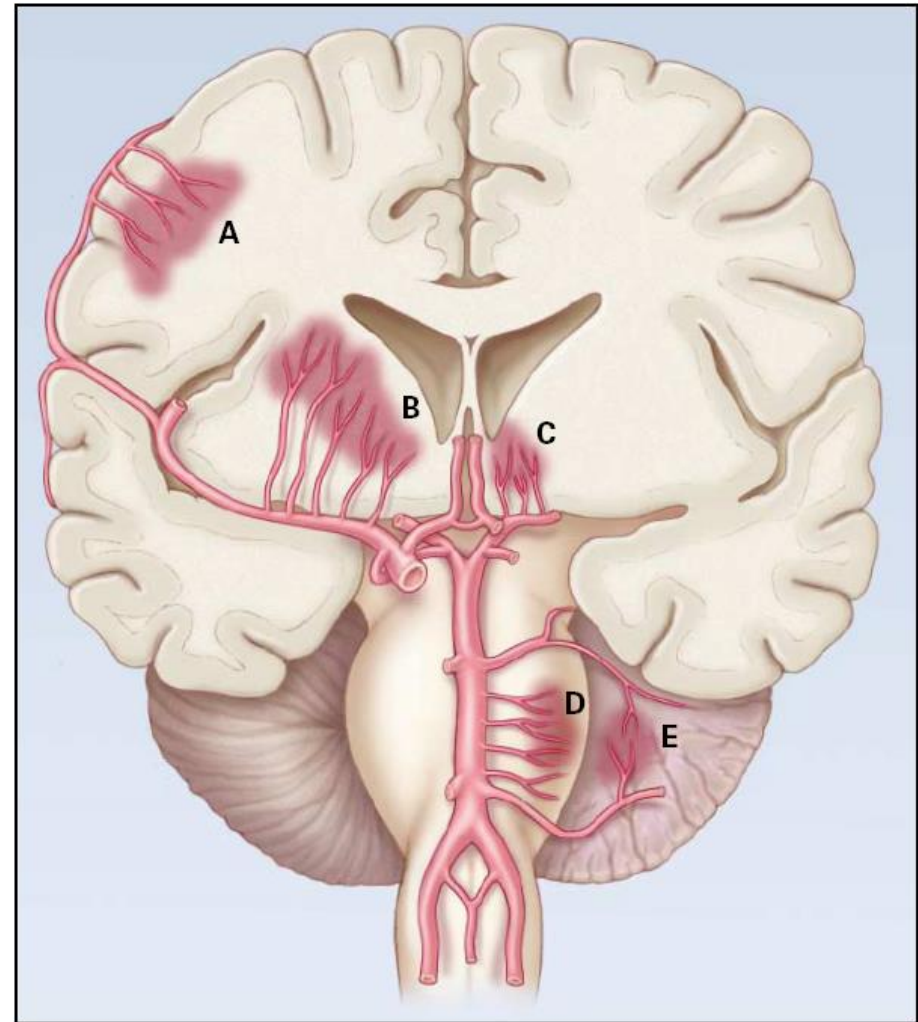
postop

Intracerebral hematoma

- Treatment strategy is still not clarified
 - It is not a surgical-technical problem!
 - There is no unequivocal answer: what to do and when

Intracerebral haematoma

(not caused by malformation)



Surgery of intracerebral haematoma



"Nurse, get on the internet, go to SURGERY.COM, scroll down and click on the 'Are you totally lost?' icon."

Surgery of IC haematoma

- Rationale:
 - Remove space occupying mass of hematoma
 - Diminish toxic effect of degrading hematoma
- Final goal: supporting restitution of brain tissue affected by hemorrhage

Strategic guidelines for surgical treatment of ICH

- Age (socio-economic background)
- Localization of the hemorrhage (deep, eloquent, **posterior fossa**)
- Volume of the clot as measured on CT
- Neurological state and follow-up (LOC)

Thank you for the attention!

