Neurointensive care after SAH

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Epidemiology

- Ischemic stroke 80/100 000/rok
- ICH 10/100 000/rok
- SAH 10/100 000/rok

- Source aneurysm in 80 %
  unknown in 20 %

Reason for grading of SAH

- measure the severity of initial neurological injury
- to provide prognostic information regarding outcome
- to guide treatment decisions
- to standardize patient assesment across medical centers for the purposes of scientific study

Current scales on SAH

• Hunt and Hess Scale	severity of SAH
• Glasgow Coma Score	severity of SAH
• WFNS Scale	severity of SAH
• Fisher Scale	severity, vasospasm
• Barrow Neurological Institute	severity, vasospasm
• Ogilvy	prognosis
• GOS (Glasgow Outcome Scale)	outcome
• Modified Rankin Scale	outcome

Hunt and Hess scale (1968)

1. Asymptomatic or minimal headache and slight neck stiffness

2. Moderate to severe headache; neck stiffness; no neurologic deficit except cranial nerve palsy

3. Drowsy; minimal neurologic deficit

4. Stuporous; moderate to severe hemiparesis; possibly early decerebrate rigidity and vegetative disturbances

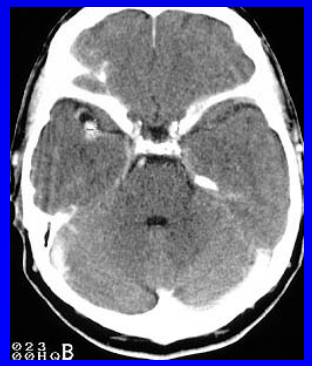
5. Deep coma; decerebrate rigidity; moribund

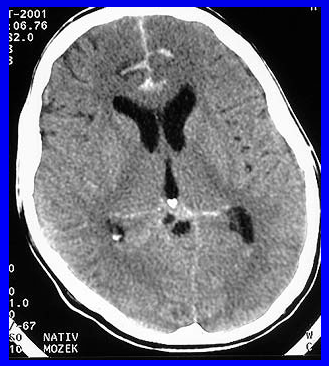
WFNS scale (1988)

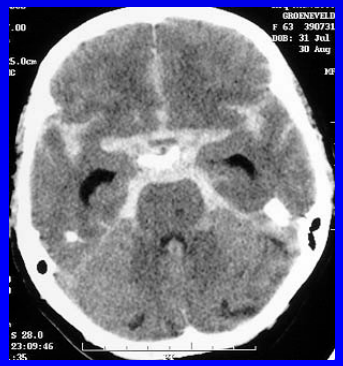
Grade	GCS	Focal neurological deficit
1	15	Absent
2	13–14	Absent
3	13–14	Present
4	7–12	Present or absent
5	<7	Present or absent

Fischer grade (1980)

Grade	Appearance of hemorrhage
1	None evident
2	Less than 1 mm thick
3	More than 1 mm thick
4	Diffuse or none with intraventricular hemorrhage or parenchymal extension







Barrow Neurological Institute SAH Grading Scale (2012)

TABLE 1. The BNI SAH Grading Scale[a]

Grade	Maximum SAH Thickness (mm)[b]
1	No visible SAH
2	≤5.0
3	>5.0 to 10.0
4	>10.0 to 15.0
5	>15.0

[a]SAH, subarachnoid hemorrhage.
[b]Thickness measured perpendicular to direction of cistern or fissure.

Ogilvy et al. (1998)

1 Younger than 50 years, not in coma, Fisher score 0–2, or aneurysm <10 mm

2 Only 1 of age >50 years, coma, Fisher score 3–4, or aneurysm >10 mm

3 Two of age >50 years, coma, Fisher score 3–4, or aneurysm >10 mm

4 Three of age >50 years, coma, Fisher score 3–4, or aneurysm >10 mm

5 Four of age >50 years, coma, Fisher score 3–4, or aneurysm >10 mm

Glasgow Outcome Scale (1975)

1. Death	Severe injury or death without recovery of consciousness
2. Persistent vegetative state	Severe damage with prolonged state of unresponsiveness and a lack of higher mental functions
3. Severe disability	Severe injury with permanent need for help with daily living
4. Moderate disability	No need for assistance in everyday life, employment is possible but may require special equipment.
5. Good outcome	No or light damage with minor neurological and psychological deficits.

Modified Rankin Scale (1988)

0 - No symptoms.

1 - No significant disability.

Able to carry out all usual activities, despite some symptoms.

2 - Slight disability.

Able to look after own affairs without assistance, but unable to carry out all previous activities.

3 - Moderate disability.

Requires some help, but able to walk unassisted.

4 - Moderately severe disability.

Unable to attend to own bodily needs without assistance, and unable to walk unassisted.

5 - Severe disability.

Requires constant nursing care and attention, bedridden, incontinent.

6 - Dead.

Decision making process in SAH

- multifactorial, complicated
- initial diagnostic algorithm, the way of securing the aneurysm and its timing.
- factors which have to be taken into consideration (grading scales, age, general medical condition, the time from the rupture, the location, size and shape of the aneurysm, the presence of intracerebral hematoma or hydrocephalus

Proof of SAH

- CT
- Lumbar puncture

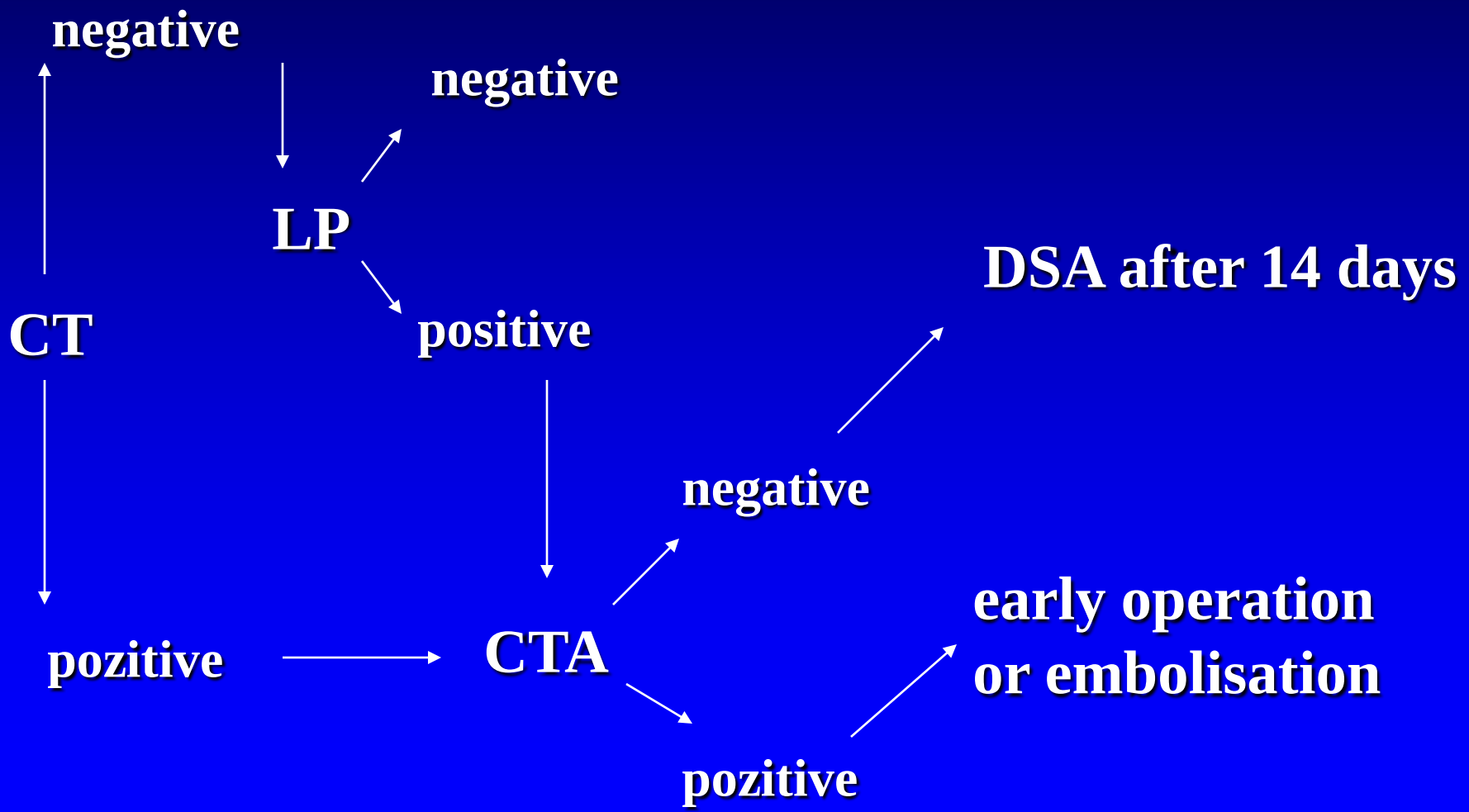
Proof of the bleeding source

- CTA, DSA
- Role of multiple aneurysms (20% of cases) – consider the distribution of blood on CT, more proximal and larger aneurysms tend to bleed

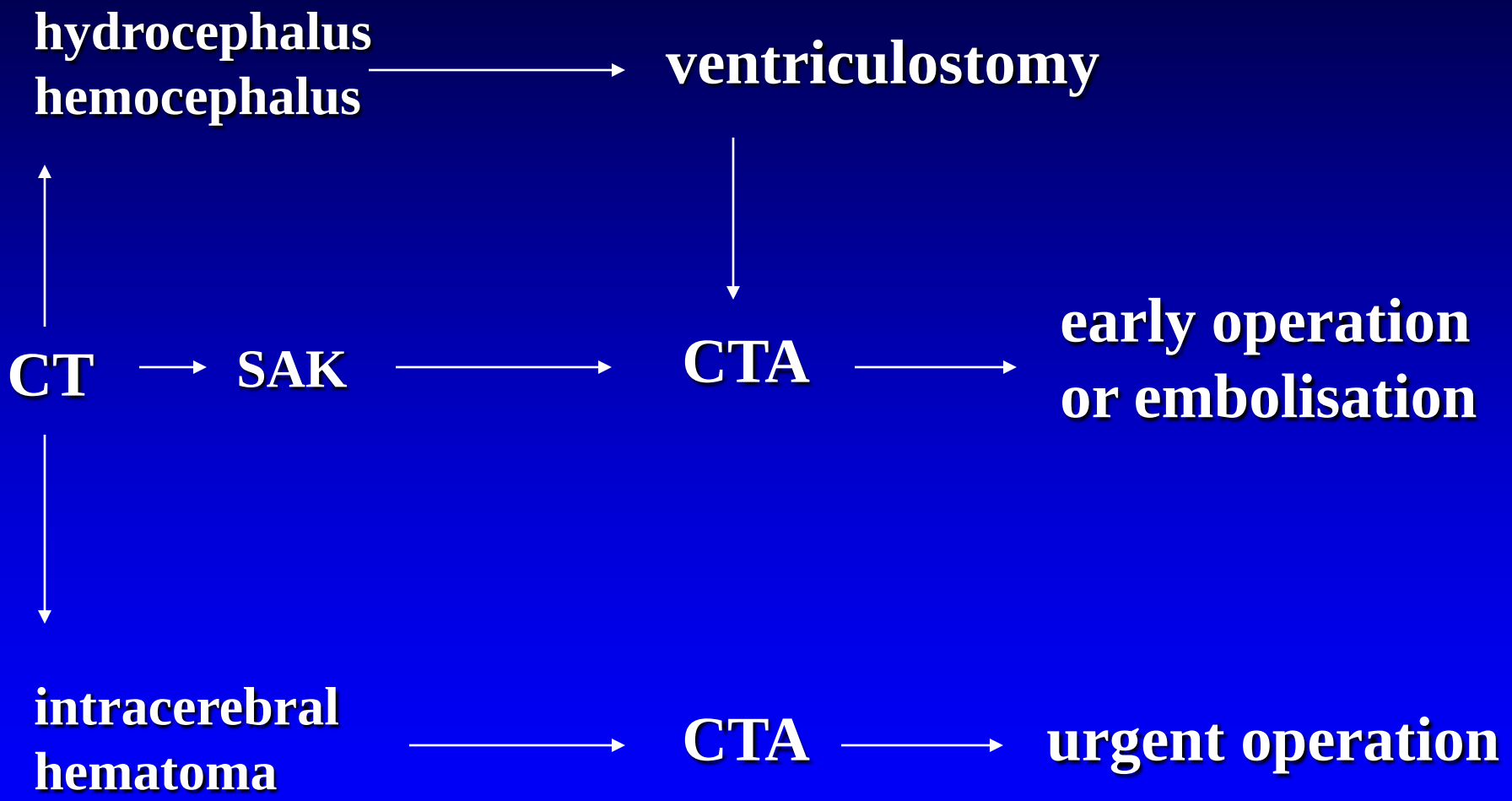
Risky pathophysiological mechanisms for SAH

- **Rebleeding** – early obliteration of the aneurysm
- **Early raised ICP** – EVD, spinal line
- **Vasospasms** – treatment on ICU

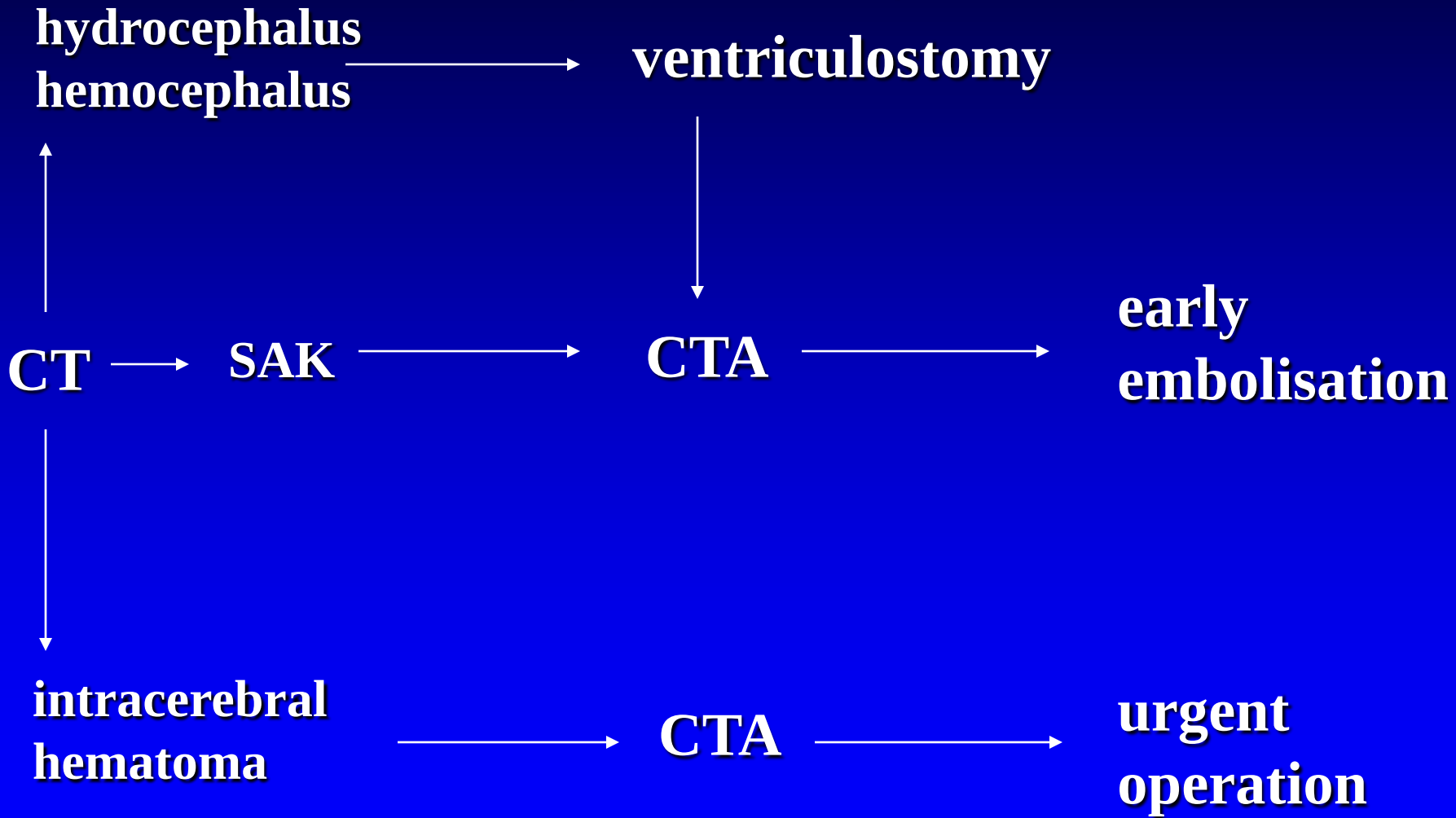
Algorithm in patients in good condition (HH I a II)



Algorithm in somnolent patients (HH III)



Algorithm in comatous patients (HH IV a V)

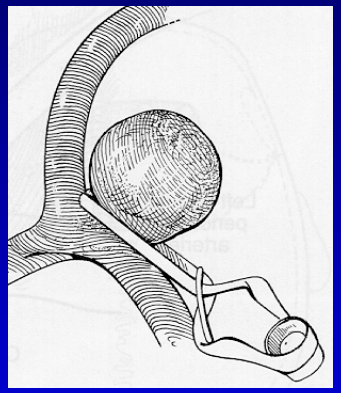


Timing for aneurysm obliteration

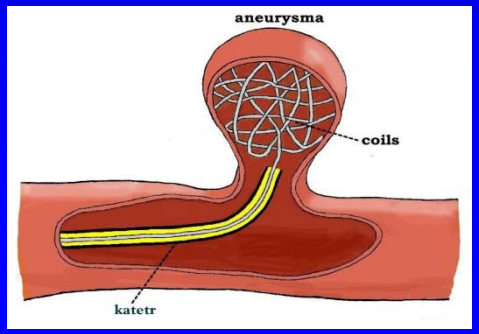
- Urgent (immediate) – intracerebral hematoma, severe condition
- Early (within 24 hours) – others
- Patients with vasospasm – usually coming several days after the rupture – individual approach – balancing the risks

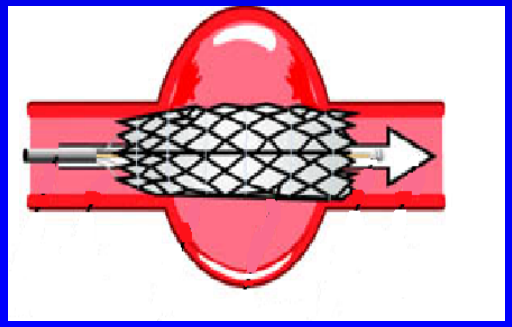
Options of aneurysm obliteration

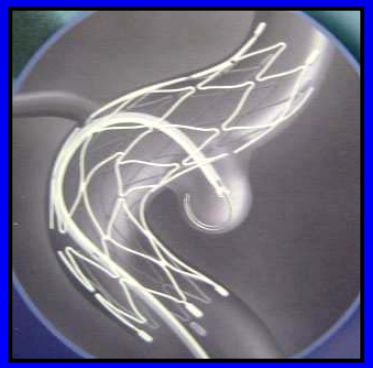
- Microsurgery (clipping, wrapping, trapping, proximal ligation)



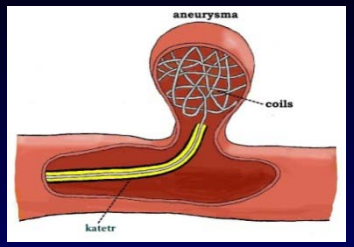
- Endovascular methods (coiling, stenting)





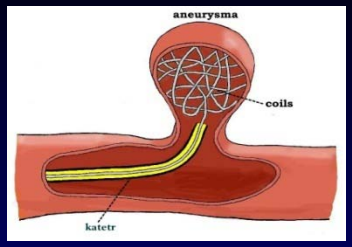


Clip or coil



- Even after the ISAT trial no definite recommendation have been established
- Both methods are still legitimate to be used.
- It depends on the preferences of a certain department and many factors here play a role (personal, technological, economical).
- Overall, however, endovascular procedures are the preferential treatment in more and more departments worldwide.

Clip or coil



- Dominantly coiling: In France, other EU countries and now also in USA
- Dominantly microsurgery (Finland, China, Japan).
- Many exceptions

Factors which influence the choice of the treatment modality

- **Age:** older pateints probably benefit from endovascular treatment.
- **Clinical status**: higher HH grade patients probably benefit from endovascular treatment
- **Location of the aneurysm**: this is related to the difficulty of open surgery in certain locations. Vertebrobasilar aneurysms, carotid-ophtalmic aneurysms, ACoA aneurysms pointing posteriorly or upwards are often treated by endovascular means

Factors which influence the choice of the treatment modality

- **Size and shape of the aneurysm**: In giant and fusiforme aneurysms sometimes bypass is needed for a correct solution. Nevertheless new endovascular tools like stents and flow diverters are promising in this field.

- **Presence of significant intracerebral hematoma**: indication for open surgery.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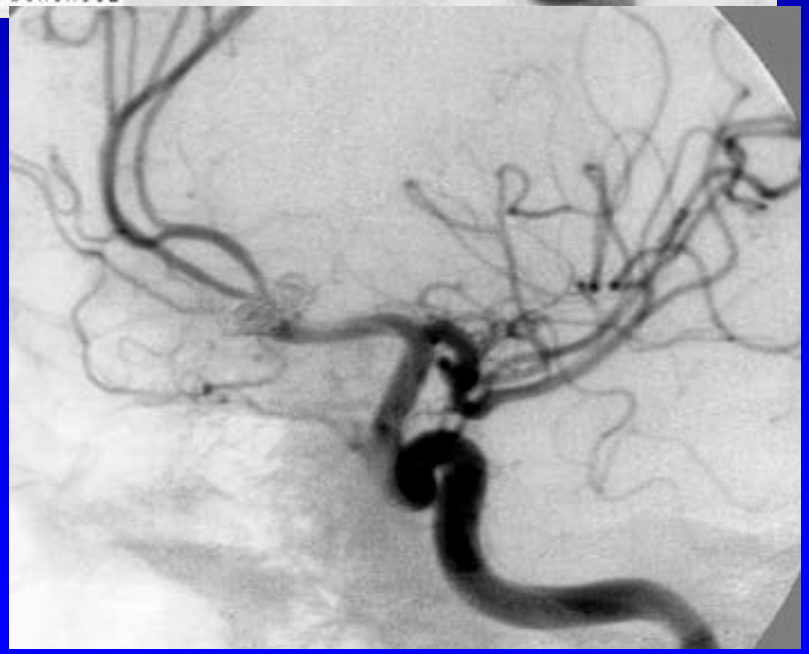

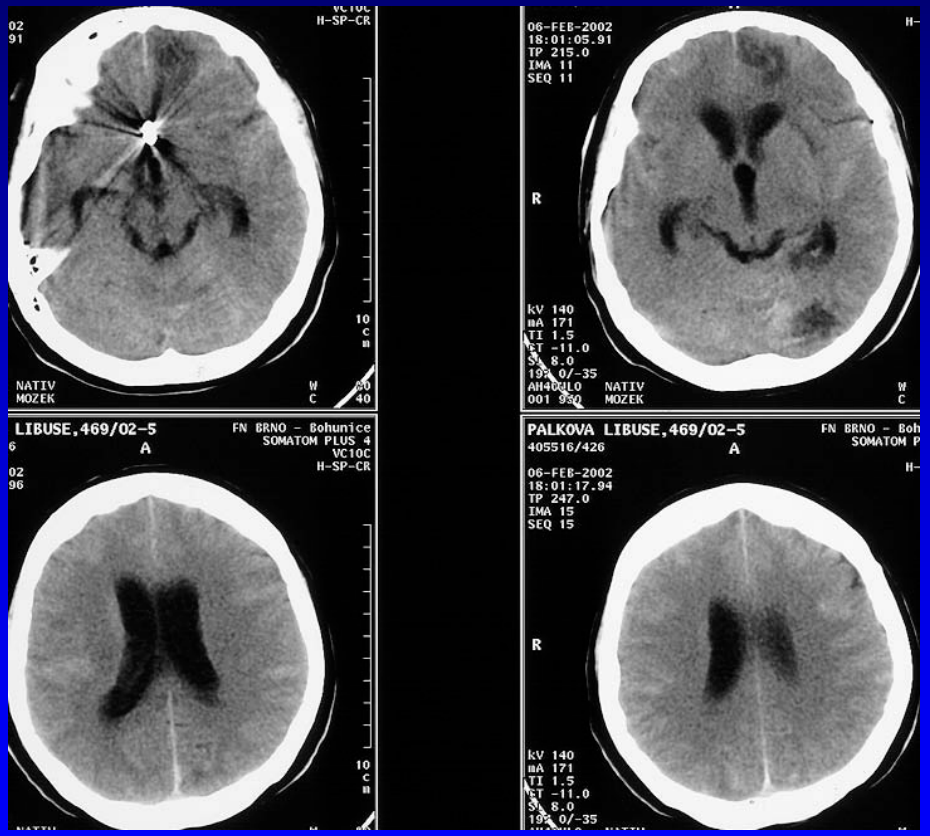
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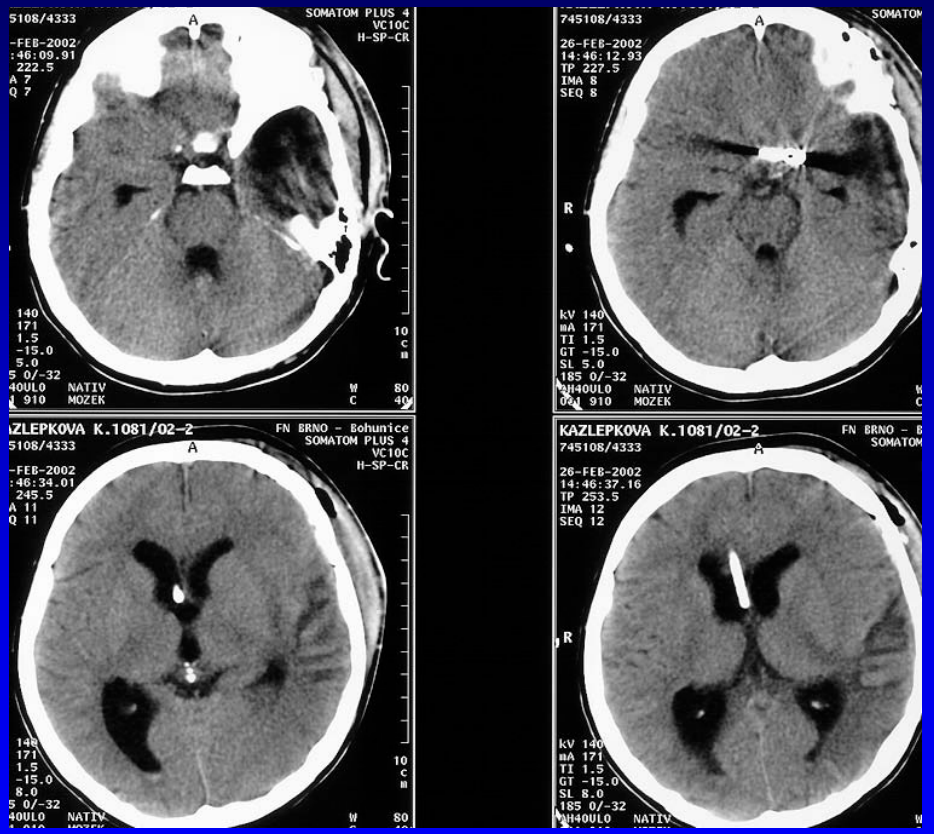
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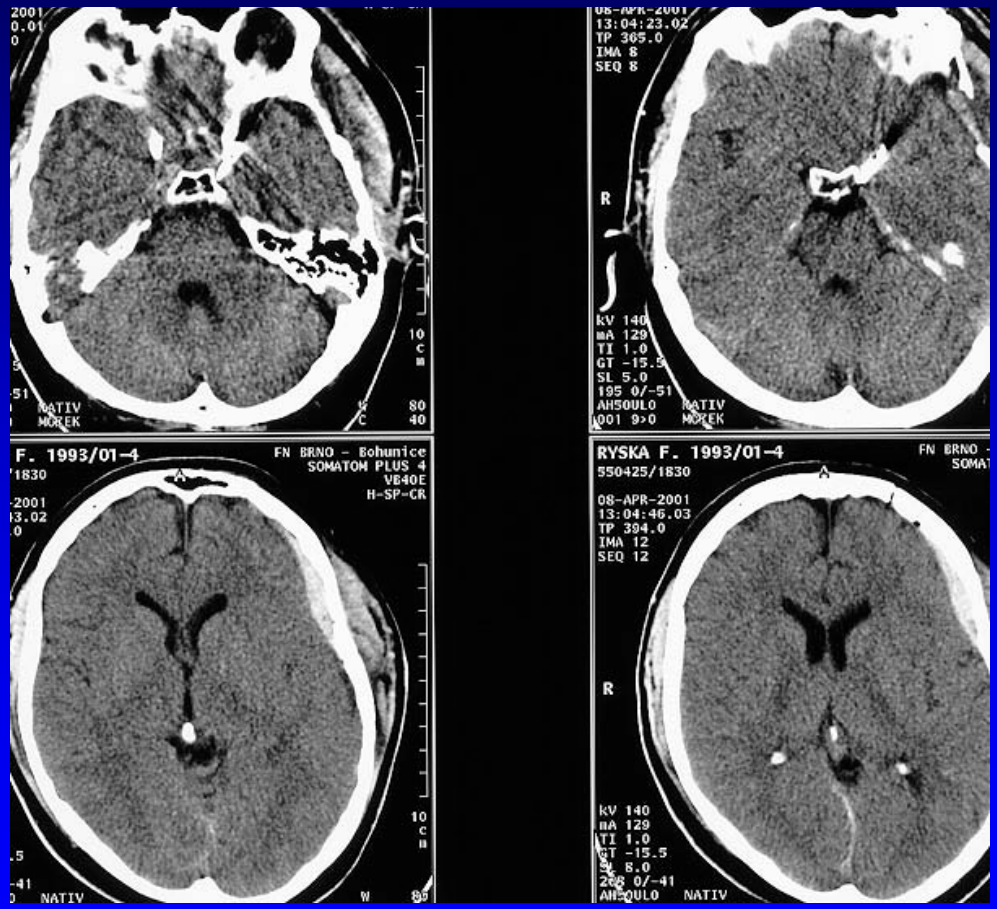
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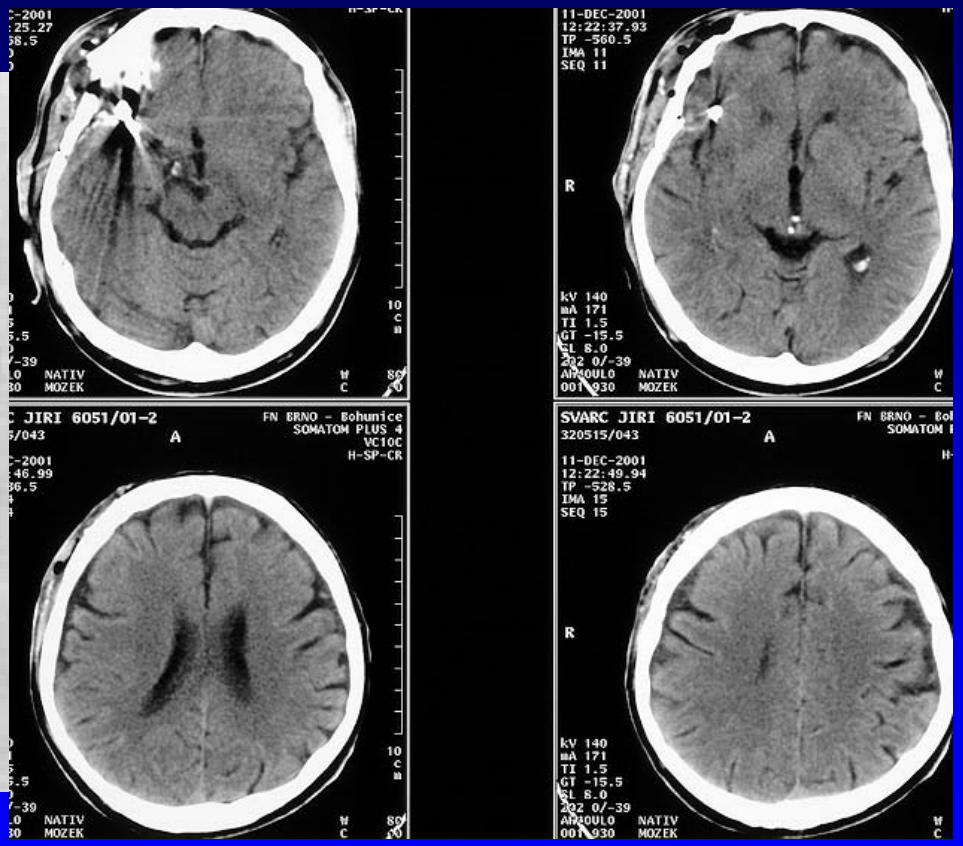
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Specific treatment on ICU – before aneurysm obliteration

- Keep the patient calm, no coughing, sneezing
- Keep the blood pressure to max.140 syst.
- Introduce EVD or spinal line – to decrease ICP, improve symptoms
- Painkillers, hemostatics (Dicynone)
- Nimodipin

Specific tretament on ICU – after aneurysm obliteration

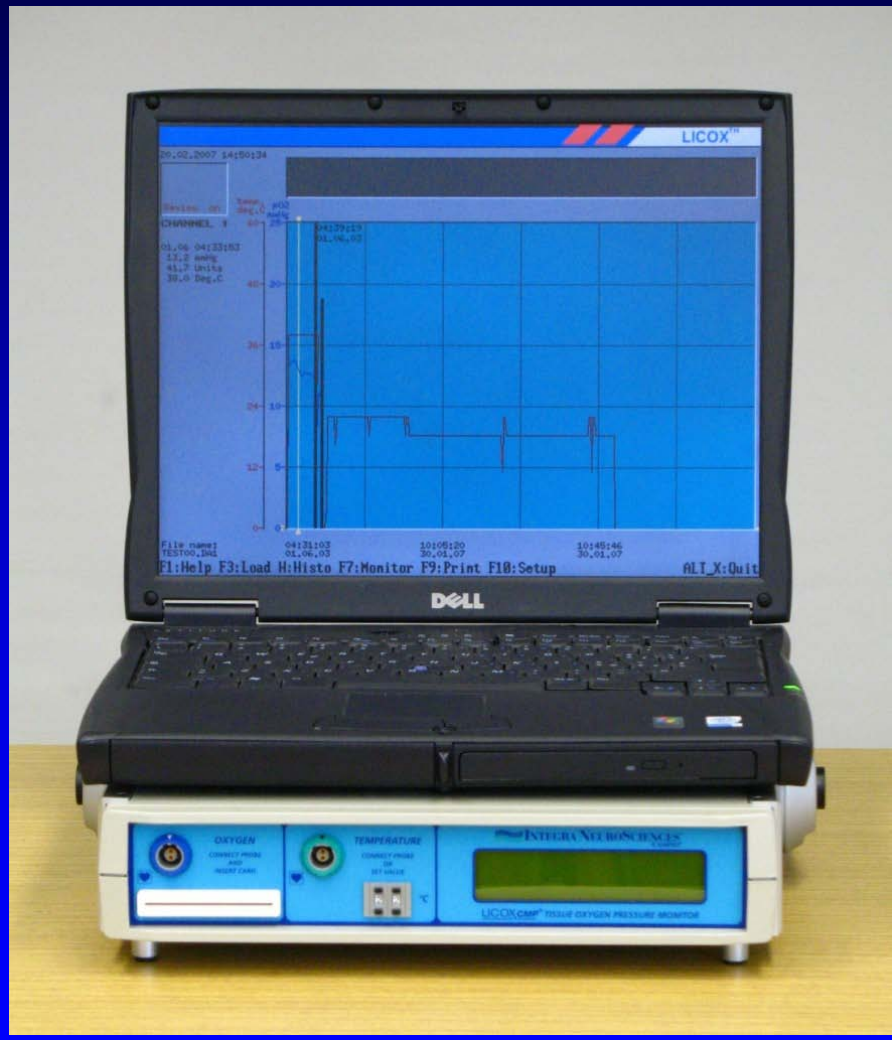
- Keep the blood pressure about 140-160 syst.
- EVD or sipnal line
- Nimodipine
- Monitoring (detection of vasospasm)

Monitoring on ICU

- **Clinical monitoring**
- **Blood pressure (syst BP is the most important)**
- TCD (transcranial dopplerometry)
- ICP (CPP)
- Tissue oxymetry
- CBF
- Microdialysis
- CT

Tissue oxymetry (PbtO2)

- Detection of focal ischemia
- Normal values above 20 mmHg
- Critical level <15 mm Hg
- Has been adopted as standard monitoring in many centres

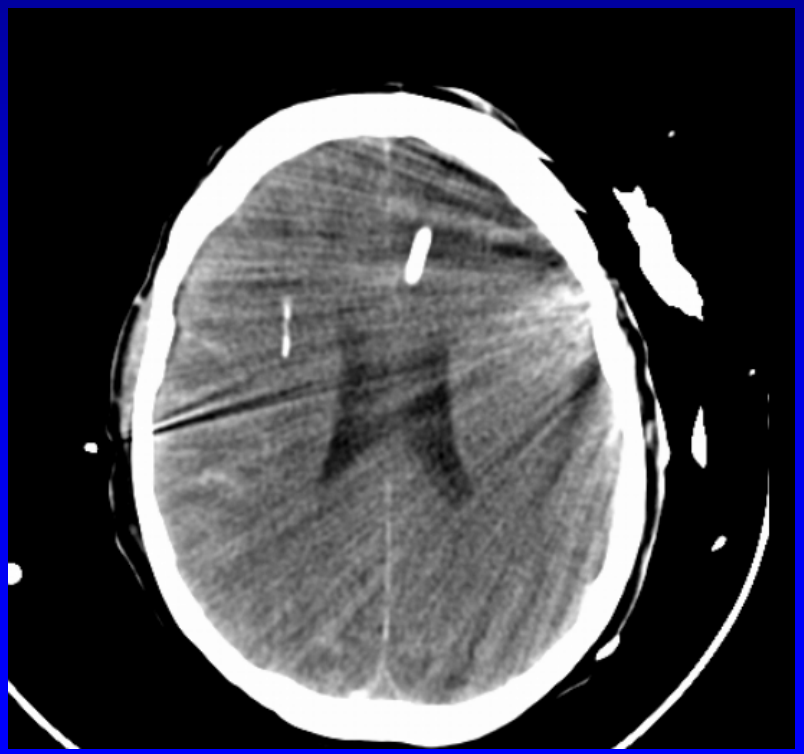


Probe for PtiO2:

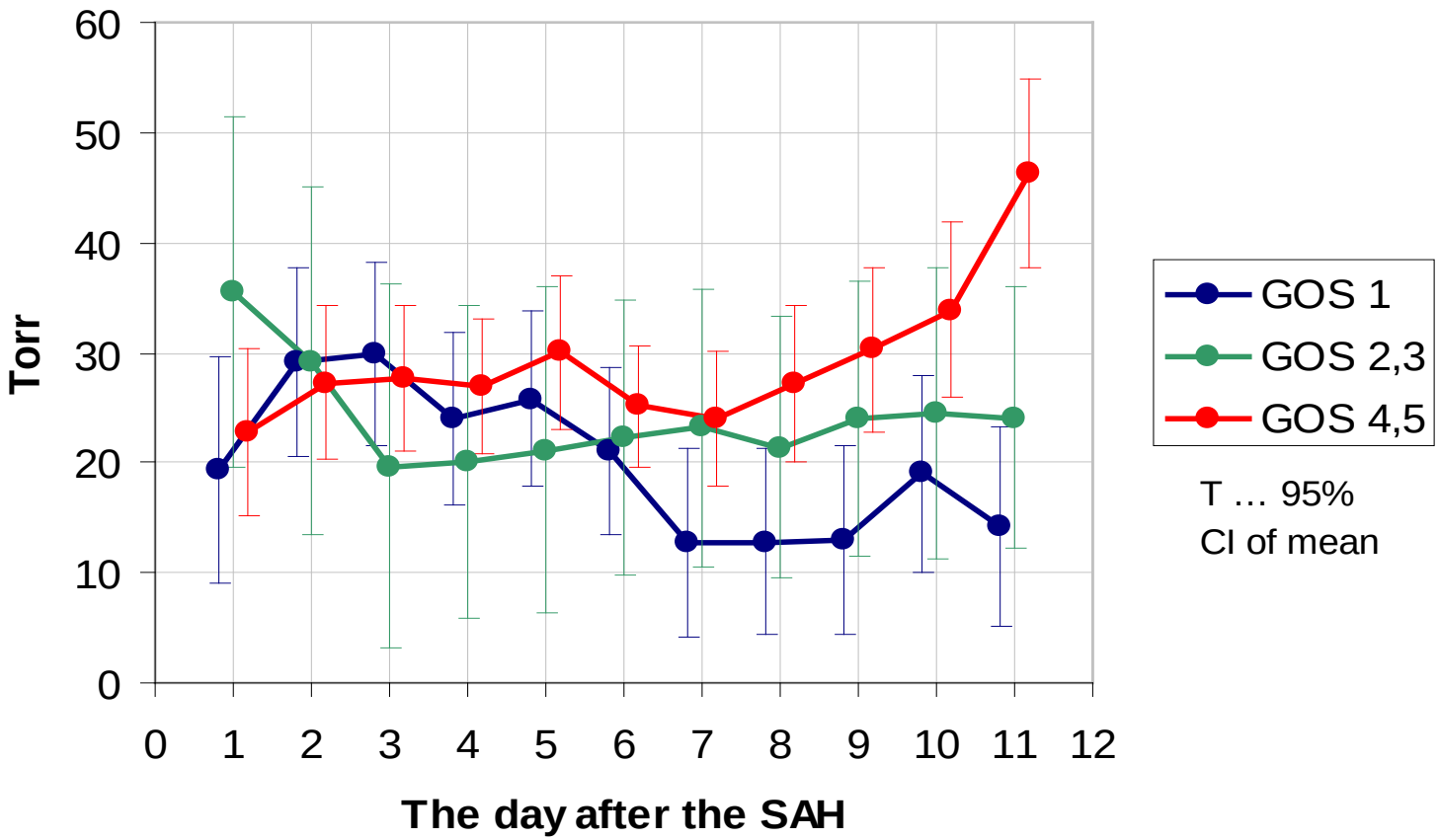
Depends on aneurysm location:

ACA – medial from Kocher´s point

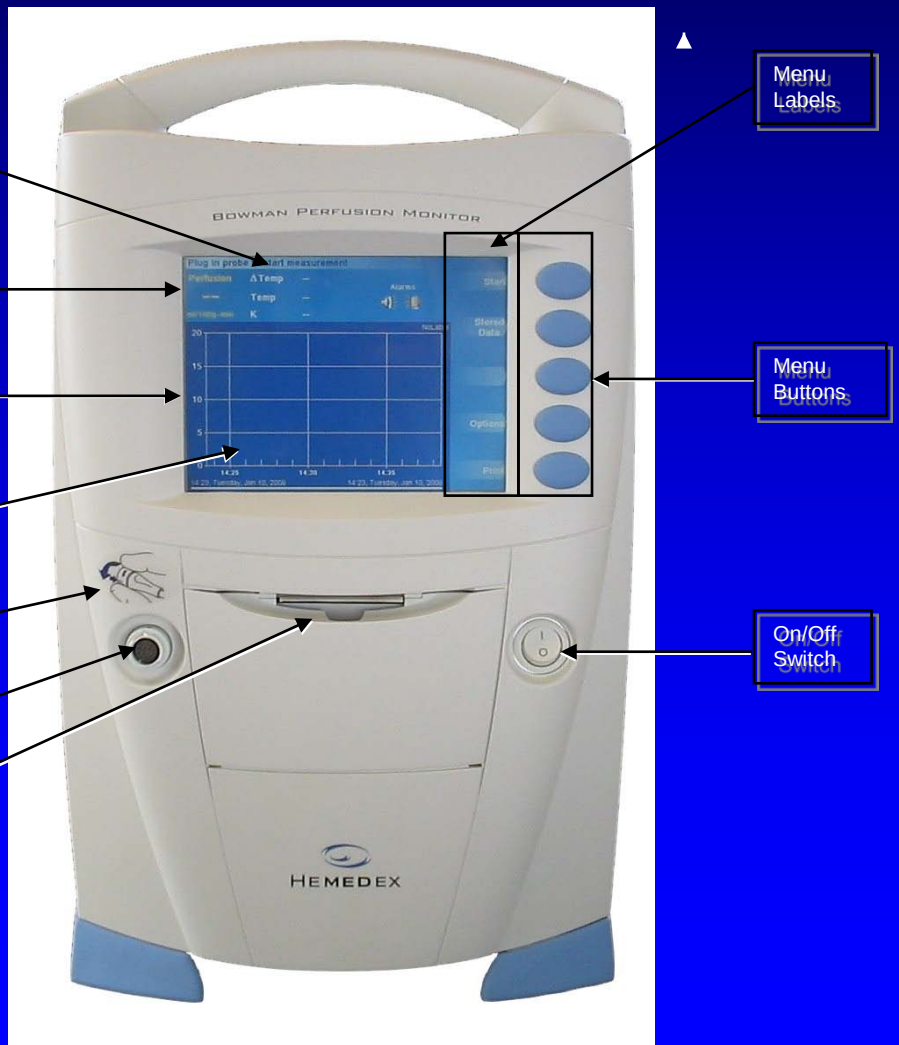
MCA – lateral from Kocher´s point



$PtiO_2$ and GOS in severe SAH



CBF monitoring



Message Line

Perfusion Numeric Display

Display Screen

Perfusion vs. Time Graph

Umbilical Cord Disconnection Instruction Label

Umbilical Cord Connector

Printer Paper Slot

Menu Labels

Menu Buttons

On/Off Switch

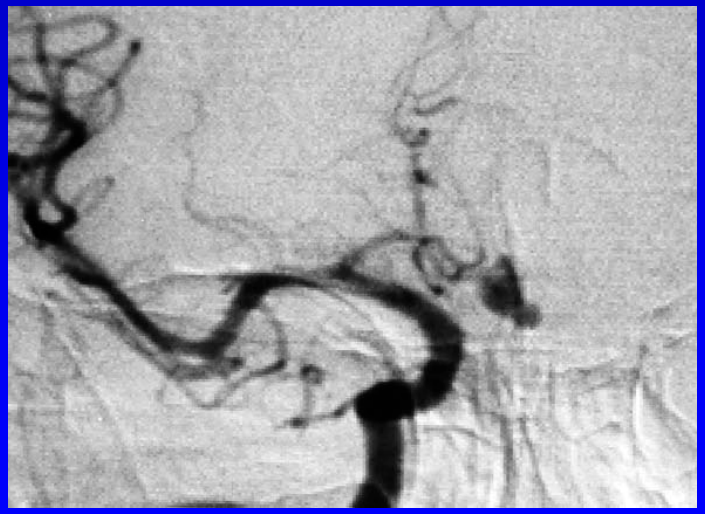
Real time monitoring

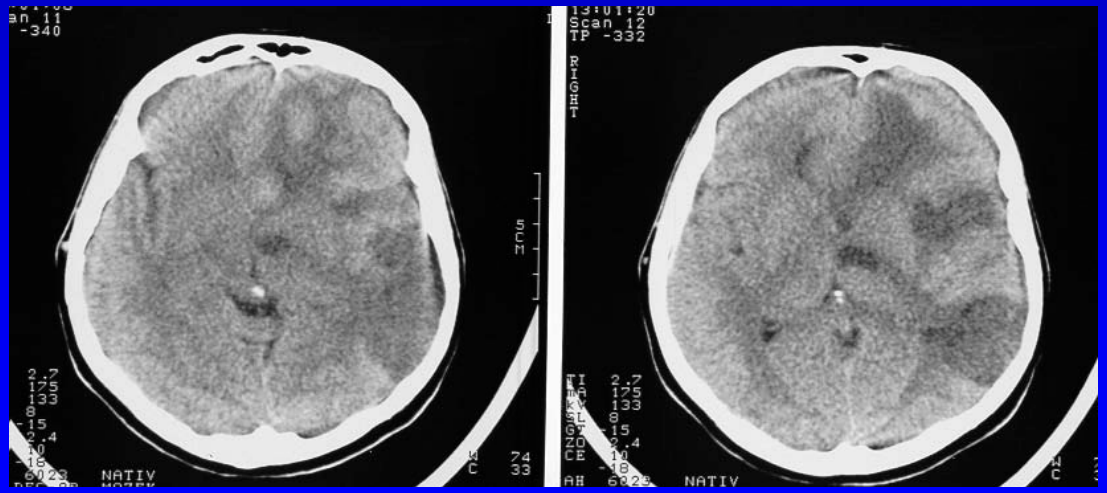
CBF in absolute values

[ml/100g.min^{-1}]

Vasospasms – main cause of mortality after SAH

- Onset 4.-14.day after SAH
- Develops in 30% of patients
- Mortality 30%



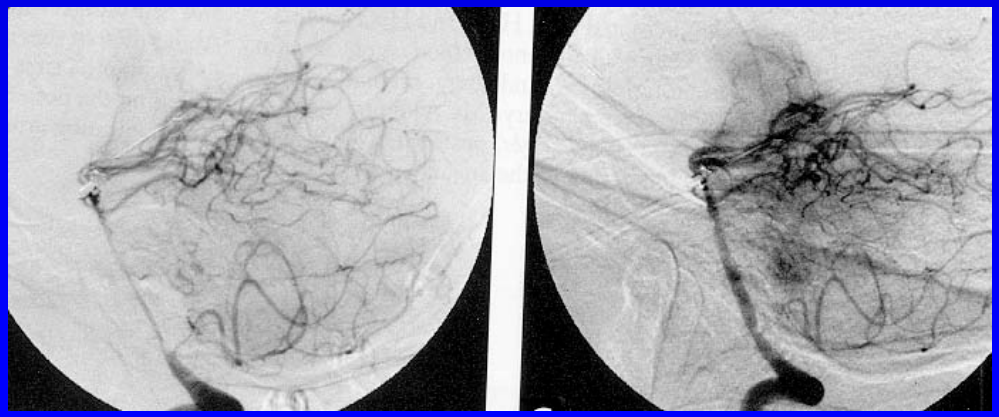


Mortality for SAH in Brno (2005-2009) (n=242)

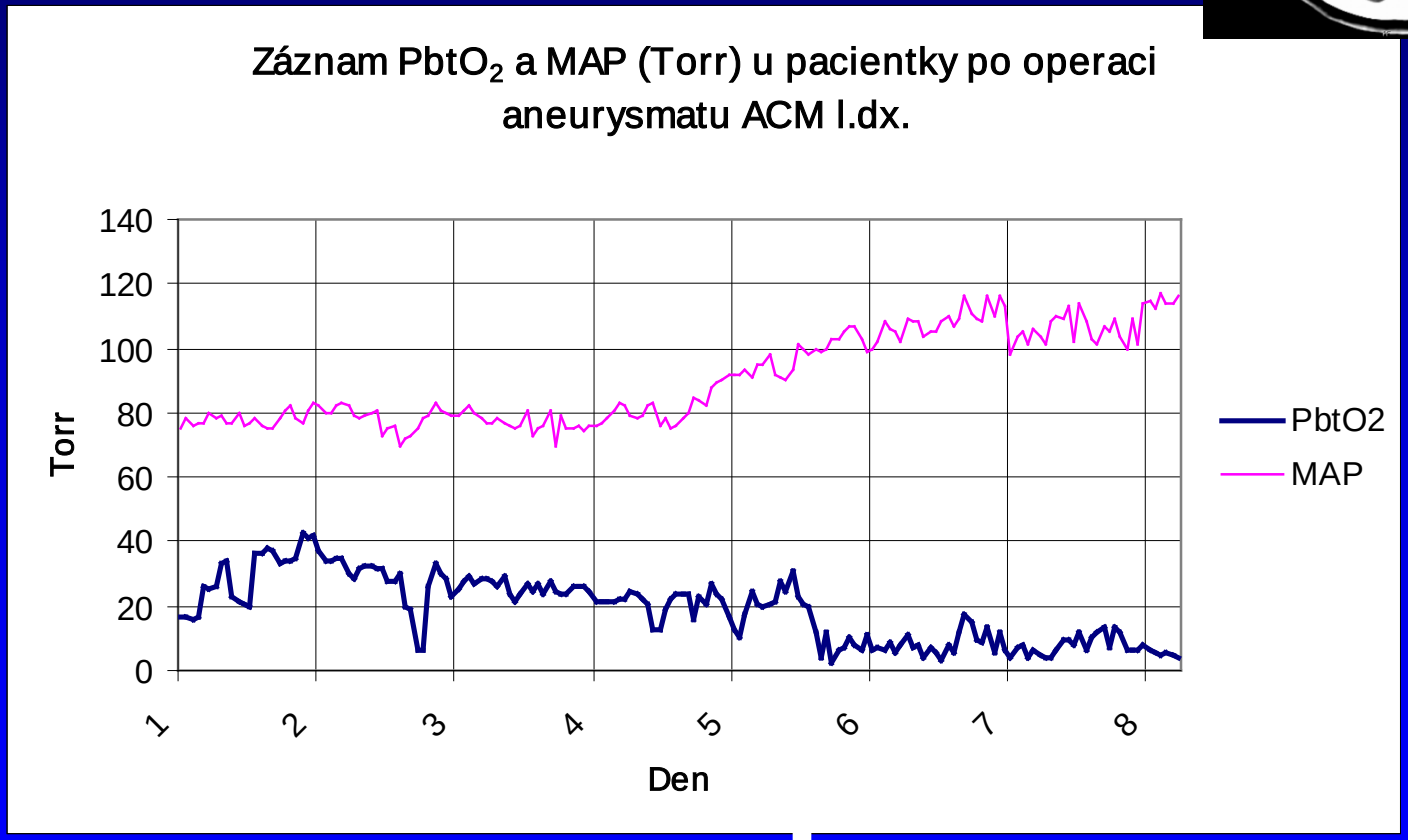
	clip (n=160)		coil (n=82)
HH I+II (n=81)	1 (1%)	**HH I+II** (n=37)	1 (3%)
HH III (n=41)	7 (17%)	**HH III** (n=18)	3 (17%)
HH IV +V (n=38)	20 (53%)	**HH IV +V** (n=27)	14 (52%)

Tretment of vasospasms

- Nimodipin – prevention (or treatment?)
- H(HH) terapie (hypertension, hemodilution, hypervolemia)
- Intrathecal or i.v. aplication of vasoactive agents
- Injection to ggl. Stellatum
- Endovascular treatment (papaverin, angioplasty)
- Mild hypothermia
- Others

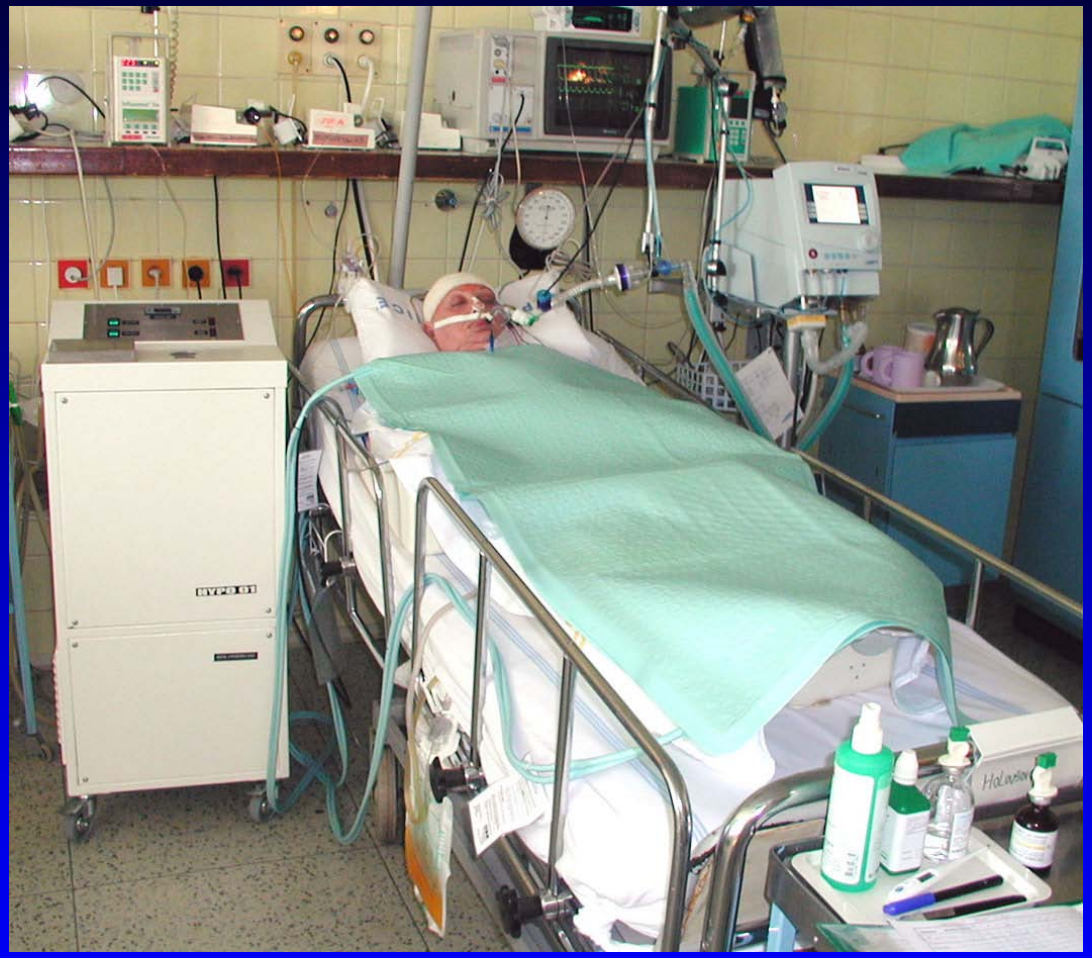


- Postoperative record - patient GOS 1
  - m=19,0 Torr
  - SD= 10,3 Torr

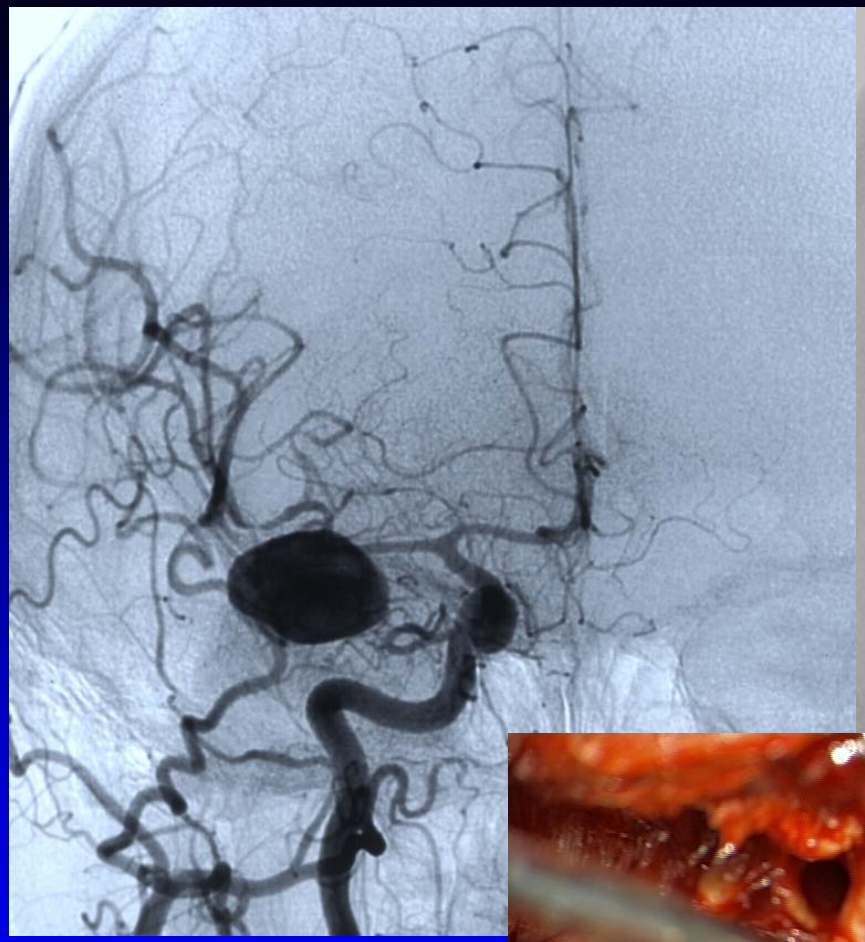


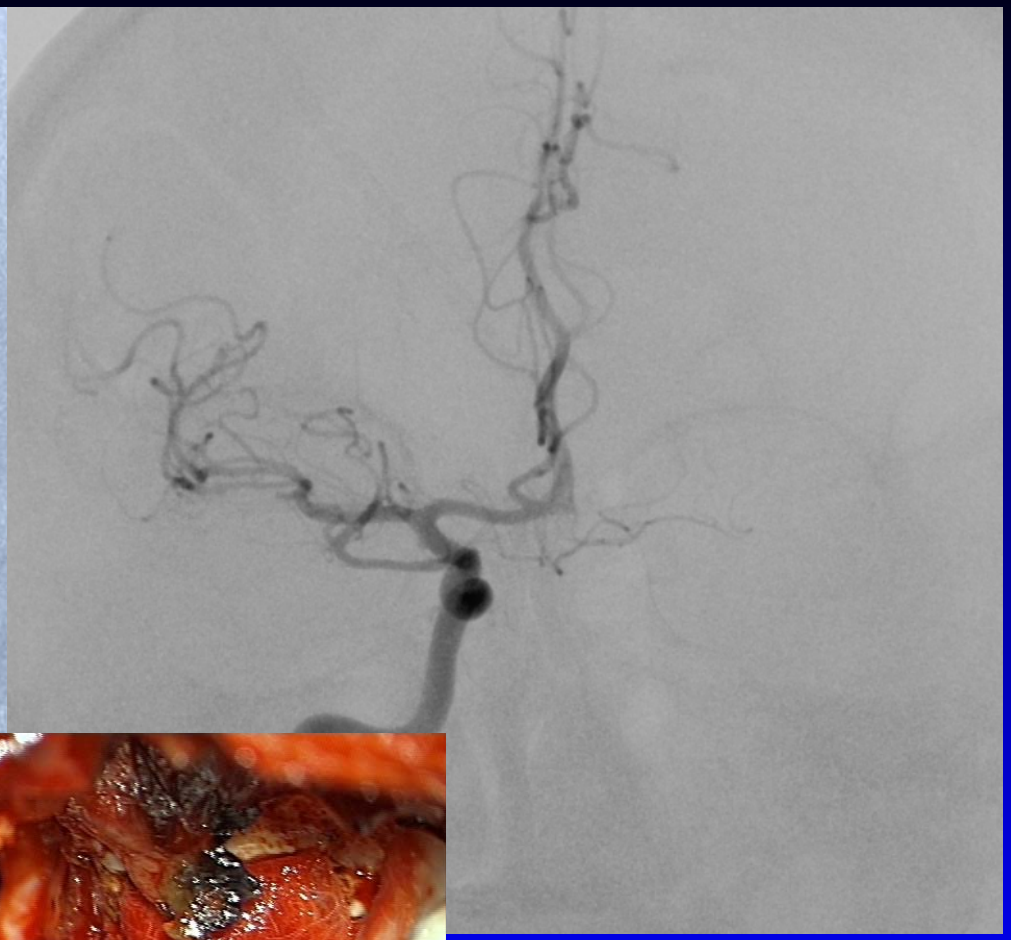
Odtlumení

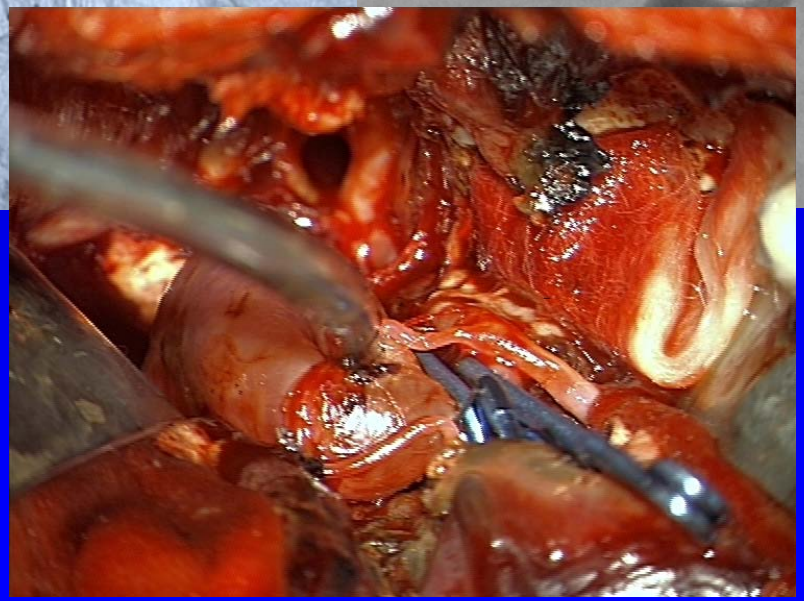
Surface cooling – 34 C



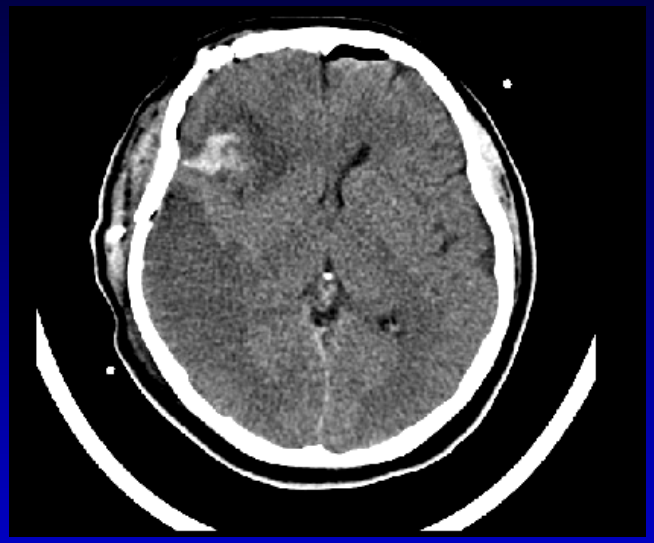
Svoboda T., Navrátil O., Smrčka M., Gál R., Břínek J.: HYPO-1 device for controlled hypothermia in the intensive care for a neurosurgical patient – first clinical experiences. Acta Neurochirurgica, 144(7), 2002, str.A34

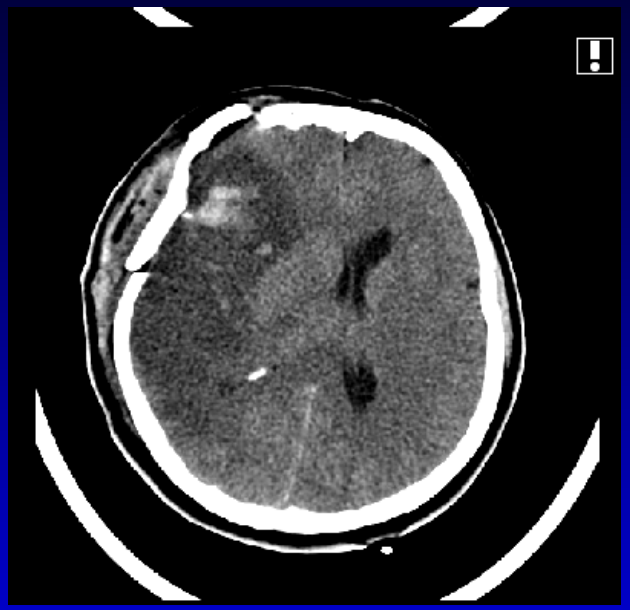


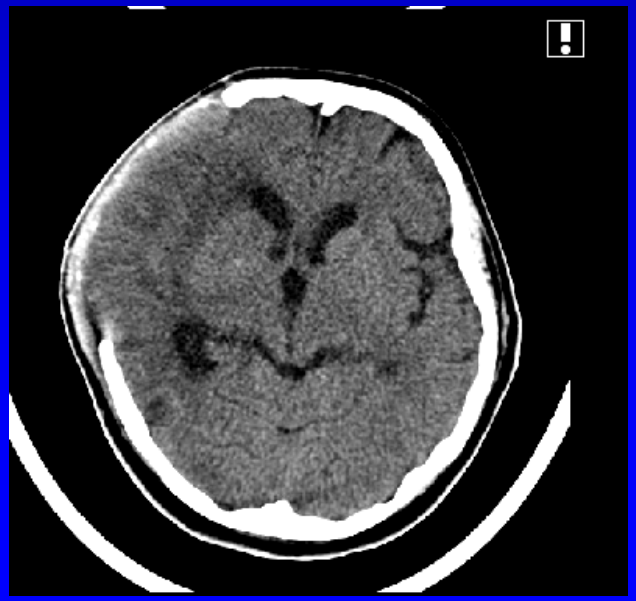


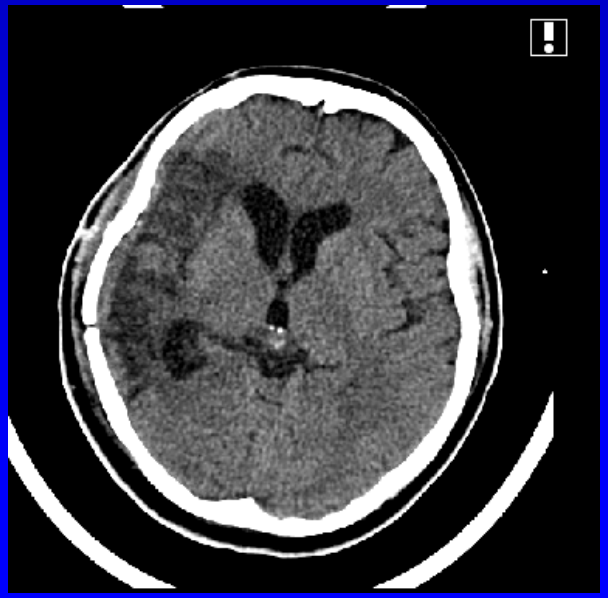


Decompressive craniectomy

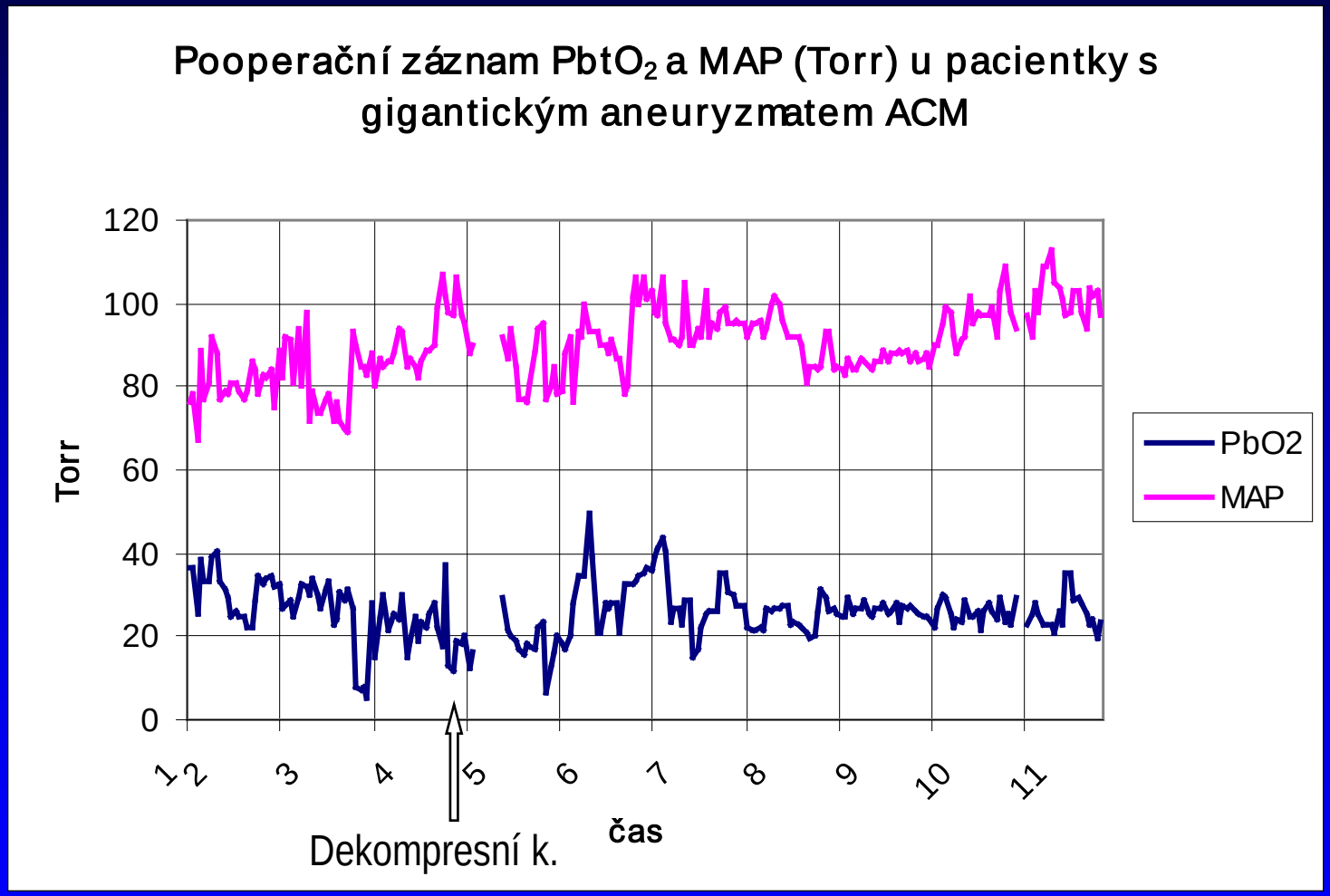








- m=25,99 Torr, SD=6,5



Conclusion

- Correct assessment and grading of SAH patients help to establish the correct individual treatment algorithm.
- Neurointensive care must be very active, dynamic, continuous, including multimodal monitoring
- Maintaining adequate perfusion is the main goal on ICU´.
- New research should aim besides the new technologies related to aneurysm occlusion particularly on group of patients in a bad clinical condition after SAH who have the worst treatment results


FAKULTNÍ NEMOCNICE BRNO