Subarachnoid Hemorrhage

Diagnosis and Acute Management

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I have no disclosures

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Department of Emergency Medicine
DARTMOUTH HITCHCOCK MEDICAL CENTER

HA = 1% of Emergency Department visits
SAH = 1% of HA (10/100,000)
50% = normal exam
85% SAH = non-traumatic
80% = aneurysmal
10% = perimesencephalic

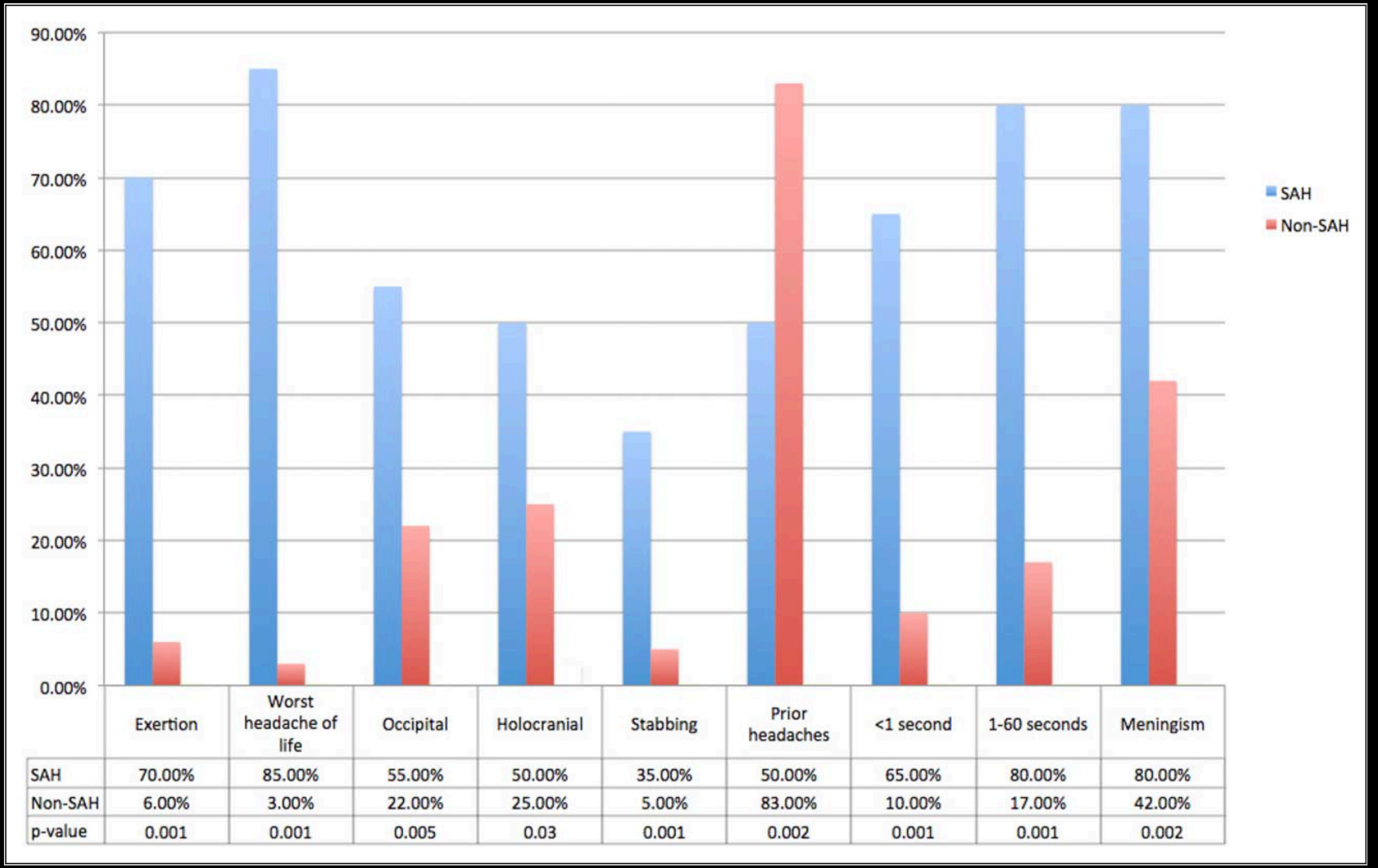
Clinical outcome at 12 months.

Outcomes	Rebleeding (n = 30)	No rebleeding (n = 267)	p value
mRS 0–2	2 (6.7%)	118 (44.1%)	<0.001
mRS 3	0	11 (4.1%)	0.610
mRS 4–5	1 (3.3%)	29 (10.9%)	0.328
Death	26 (86.7%)	108 (40.4%)	<0.001
Lost to follow-up	1 (3.3%)	1 (0.5%)	0.483

Zhao J Neurolog Sciences 2016


HEADACHE
This sucks.

World Federation of Neurological Surgeons Scale[43]			Hunt and Hess Scale[44]		Modified Fisher Scale[45]		
Grade	Glasgow Coma Scale	Neurologic Examination	Grade	Neurologic Examination	Scale	Subarachnoid Hemorrhage	Intraventricular Hemorrhage
1	15	No motor deficit	1	Awake, alert, no cranial nerve or motor deficits, mild headache, minimal or no nuchal rigidity	0	Absent	Absent
2	13–14	No motor deficit	2	Awake, alert, moderate to severe headache, nuchal rigidity, no motor deficits, may have cranial nerve deficit	1	Thin	Absent
3	13–14	Motor deficit	3	Confusion or lethargy, with or without mild focal neurologic deficits	2	Thin	Present
4	7–12	With or without motor deficit	4	Stuporous, more severe focal neurologic deficit	3	Thick[b]	Absent
5	3–6	With or without motor deficit	5	Comatose, motor posturing or no motor response	4	Thick[b]	Present

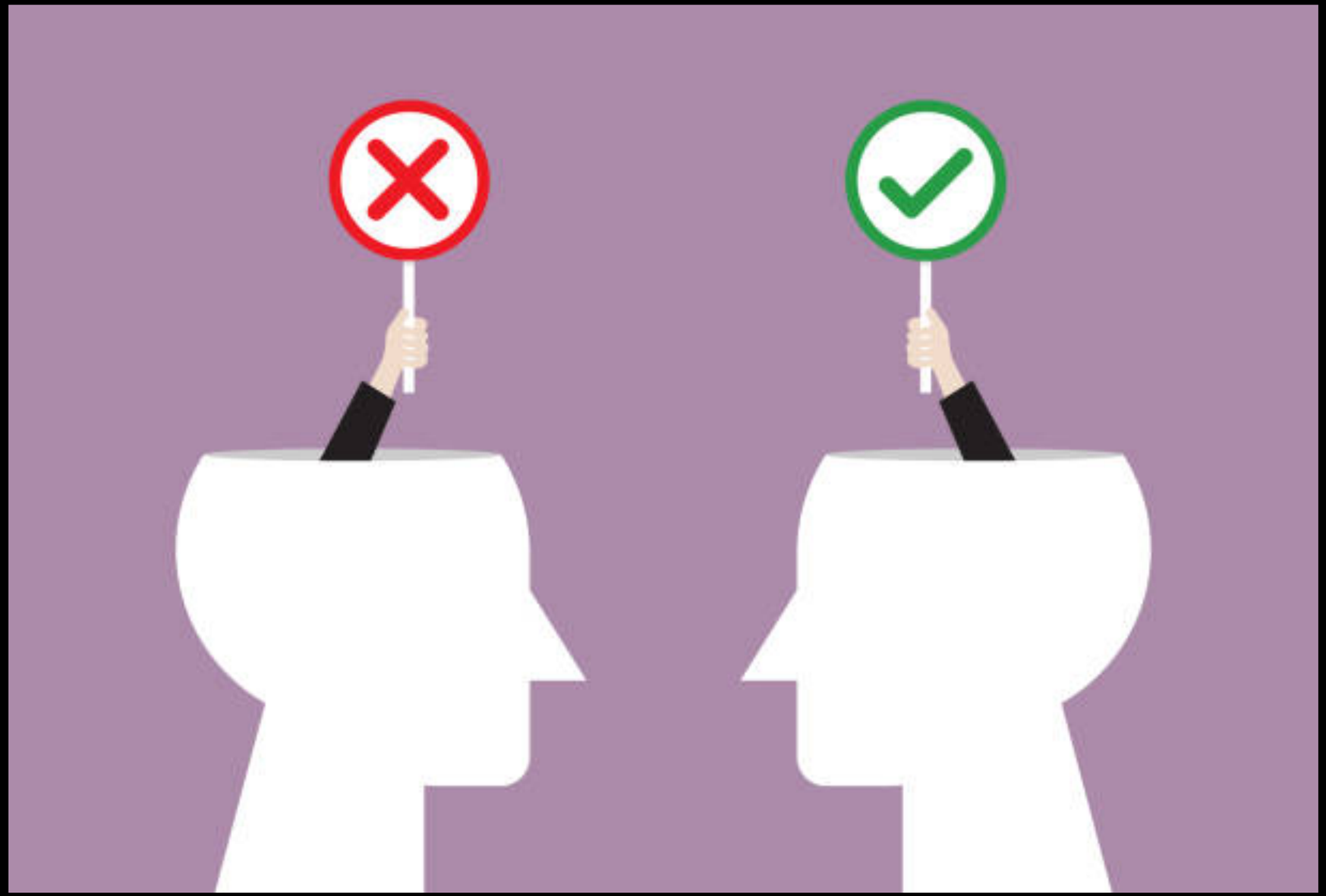


	Exertion	Worst headache of life	Occipital	Holocranial	Stabbing	Prior headaches	<1 second	1-60 seconds	Meningism
SAH	70.00%	85.00%	55.00%	50.00%	35.00%	50.00%	65.00%	80.00%	80.00%
Non-SAH	6.00%	3.00%	22.00%	25.00%	5.00%	83.00%	10.00%	17.00%	42.00%
p-value	0.001	0.001	0.005	0.03	0.001	0.002	0.001	0.001	0.002

MacGrory *Headache* 2018;58:364-370


NDC 0641-0121-21
Hydromorphone
HCl Injection, USP
2 mg/mL

SAH
SAH
SAH
Central sinus thrombosis
Hypertensive encephalopathy
Idiopathic intracranial hypertension
Acute ischemic stroke
Pituitary apoplexy
Acute glaucoma
Carbon monoxide toxicity
Dissection
Vasculitis
Meningitis
AVM
RCVS
PRES



BMJ

BMJ 2011;343:d4277 doi: 10.1136/bmj.d4277

RESEARCH

Sensitivity of computed tomography performed within six hours of onset of headache for diagnosis of subarachnoid haemorrhage: prospective cohort study

Perry *BMJ* 2011

Sensitivity of Early Brain Computed Tomography to Exclude Aneurysmal Subarachnoid Hemorrhage

A Systematic Review and Meta-Analysis

Nicole M. Dubosh, MD; M. Fernanda Bellolio, MD; Alejandro A. Rabinstein, MD; Jonathan A. Edlow, MD

- ✓ Accurate timing
- ✓ Isolated thunderclap
- ✓ No meningismus
- ✓ Normal neuro exam
- ✓ 3rd gen scanner
- ✓ No motion artifact
- ✓ Cuts ≤ 5 mm
- ✓ Hematocrit > 30%
- ✓ Reading radiologist
- ✓ Indication communicated

Stroke 2016;47:750-55

Ottawa SAH Rule

The Ottawa Subarachnoid Hemorrhage Rule is for alert patients > 15 years old with new severe non-traumatic headache reaching maximum intensity within 1 hour

Not for patients with new neurological deficets, previous anerysms, SAH, brain tumours, or history of similar headaches (≥3 episodes over ≥6 months)

Patients require investigation if **one or more** findings present:

1. **Symptoms of neck pain or stiffness**
2. **Age ≥ 40 years old**
3. **Witnessed loss of consciousness**
4. **Onset during exertion**
5. **Thunderclap headache (peak intensity immediately)**
6. **Limited neck flexion on exam**

Perry *JAMA* 2013

Perry *CMAJ* 2017

BMJ

BMJ 2011;343:d4277 doi: 10.1136/bmj.d4277

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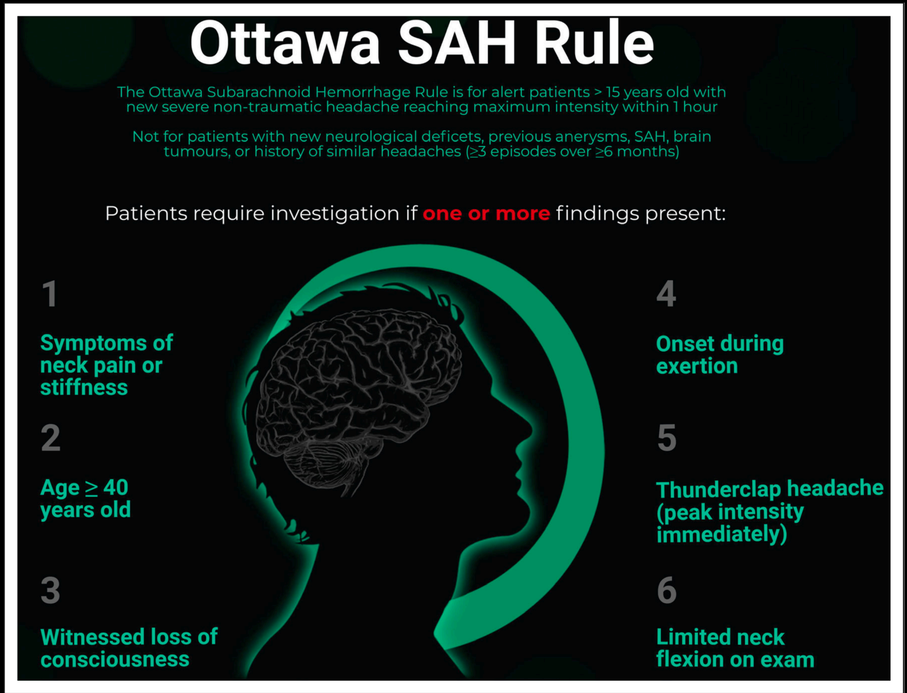

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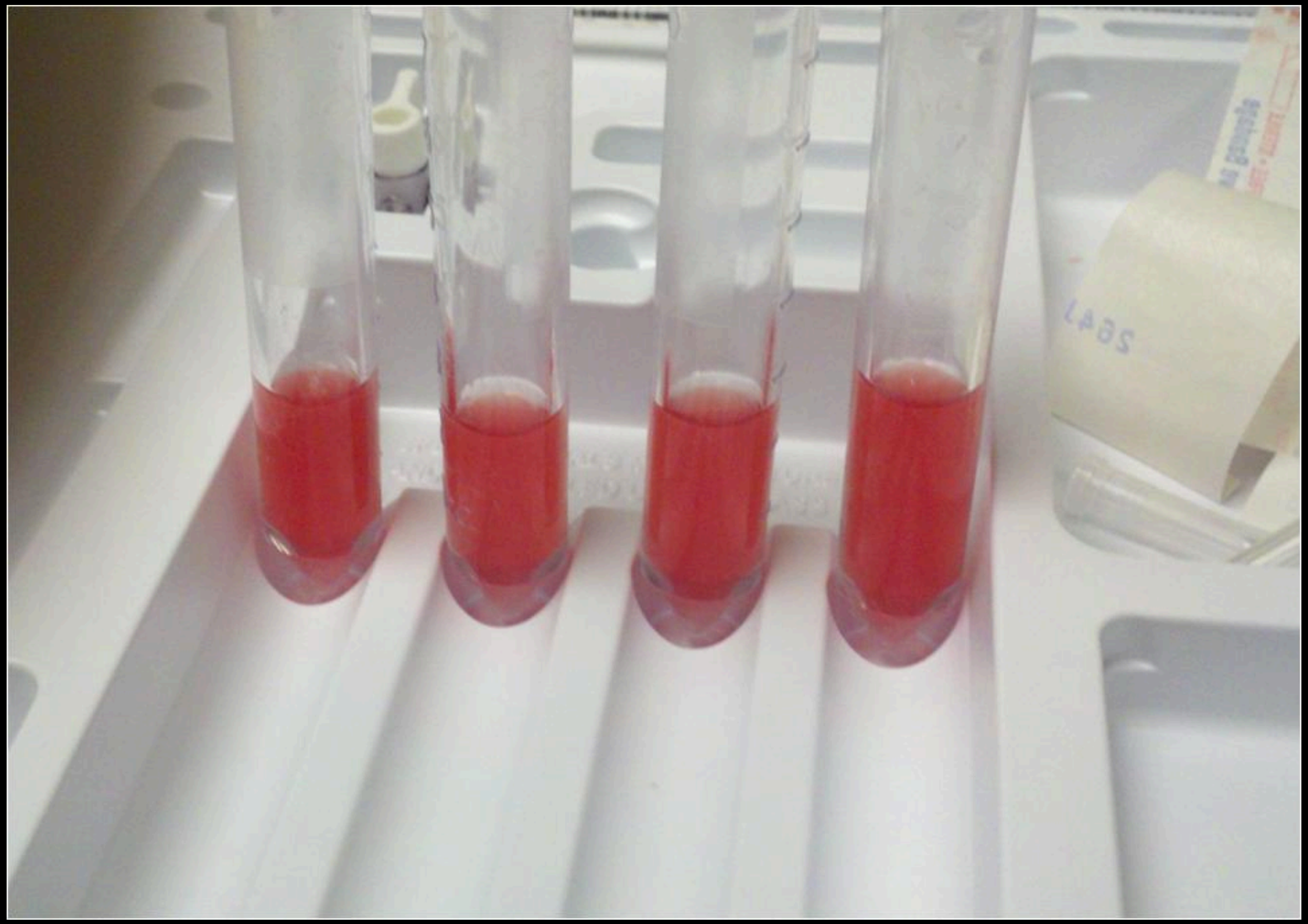
	SAH	
	Yes	No
6-h CT rule (N=1204)		
Positive	106	0
Negative	5	1093
Sensitivity (95% CI)	95.5 (89.8–98.5)	
Specificity (95% CI)	100.0 (99.7–100.0)	
Ottawa SAH rule (N=3672)		
High risk	188	3040
Low risk	0	444
Sensitivity (95% CI)	100.0 (98.1–100.0)	
Specificity (95% CI)	12.7 (11.7–13.9)	

Perry *Stroke* 2020


LABS

Differentiation Between Traumatic Tap and aSAH

RBC < 2000 x $10^{6/L}$

+

No Xanthochromia

100% sensitive!

Perry *BMJ* 2015

CT + CTA?

ACEP

CLINICAL POLICY

Clinical Policy: Critical Issues in the Evaluation and Management of Adult Patients Presenting to the Emergency Department With Acute Headache

Approved by the ACEP Board of Directors June 26, 2019

Clinical Policy Endorsed by the Emergency Nurses Association (July 31, 2019)

From the American College of Emergency Physicians Clinical Policies Subcommittee (Writing Committee) on Acute Headache:

Wolf *Ann Emerg Med* 2019

ACEP

Can we use 6-hour rule instead of LP?

Yes, in selected patients
You might miss other diagnoses
You might miss a SAH

Wolf *Ann Emerg Med* 2019

ACEP

After a negative noncon CT, is CTA as effective as LP?

CTA helps you avoid:
Low diagnostic yield, traumatic tap, uninterpretable results, post-LP headache

CTA can also result in:
Increase radiation, miss other diagnoses, identify non-bleeding aneurysms that lead to unnecessary invasive procedures

Wolf *Ann Emerg Med* 2019

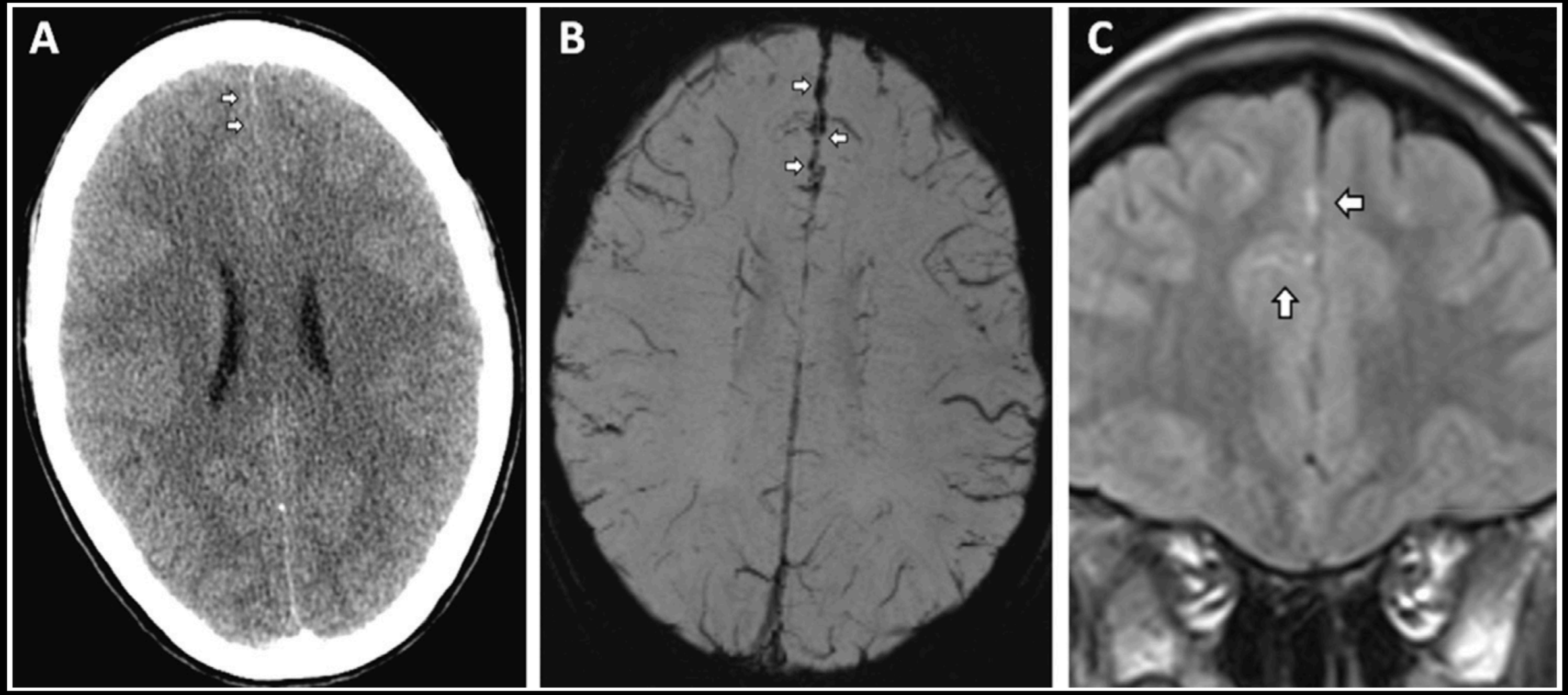
AHA/ASA

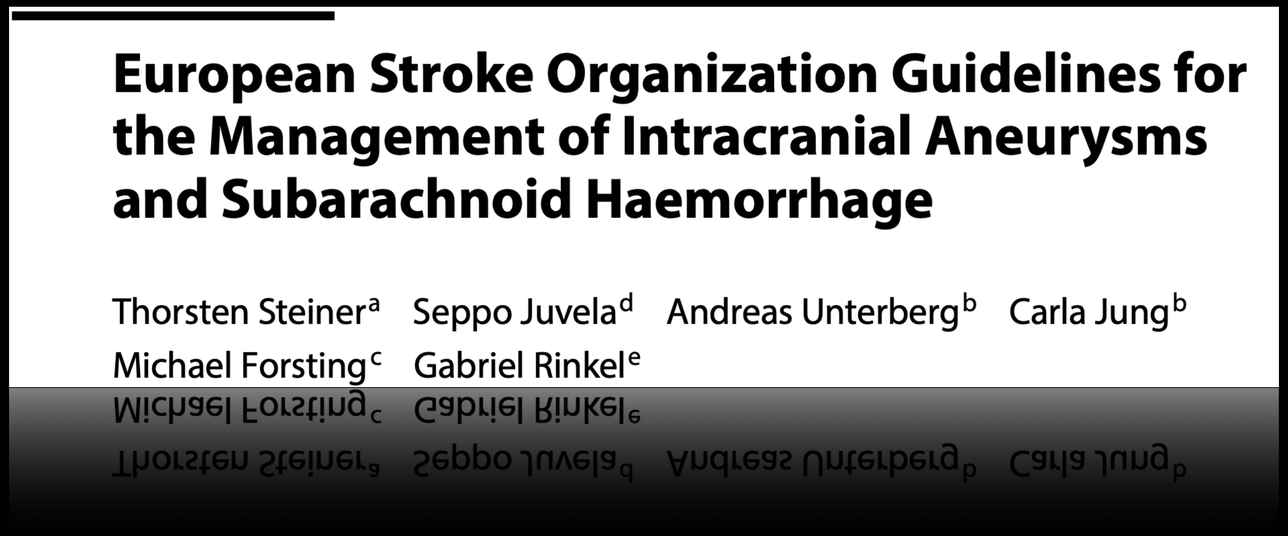
After a negative noncon CT:

If >6 hours, or with new neuro deficit, get the LP

If <6 hours, and no neuro deficit, CT is reasonable if:
High quality scanner
Board certified neuroradiologist

Hoh *Stroke* 2023


A
B
C



CT/CTA = MRI with multiple sequences are suitable for diagnosis within 24 hours
LP must be performed if CT or MRI does not confirm diagnosis

Steiner *Cerebrovasc Dis* 2013

NICE National Institute for Health and Care Excellence

NICE guideline

If a CT in <6 hours is negative:
-do not routinely offer LP
-seek advice from a specialist

If > 6 hours is negative:
-consider LP

Published Nov 2022

Acta Neurochirurgica (2025) 167:193
https://doi.org/10.1007/s00701-025-06602-8

RESEARCH

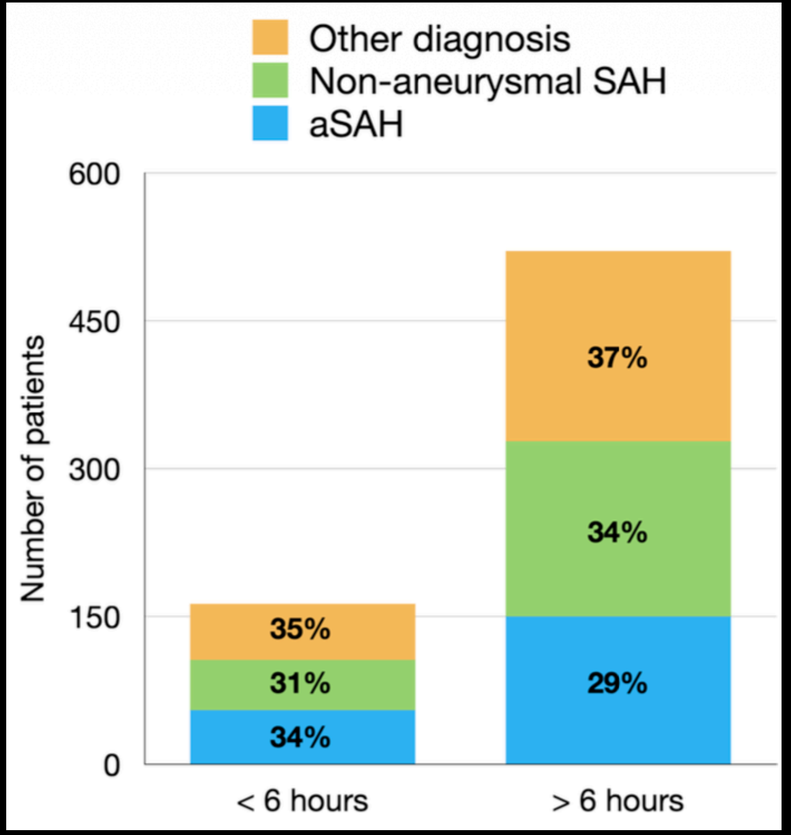
Multicentre study of the role of lumbar puncture in the diagnosis of spontaneous subarachnoid haemorrhage

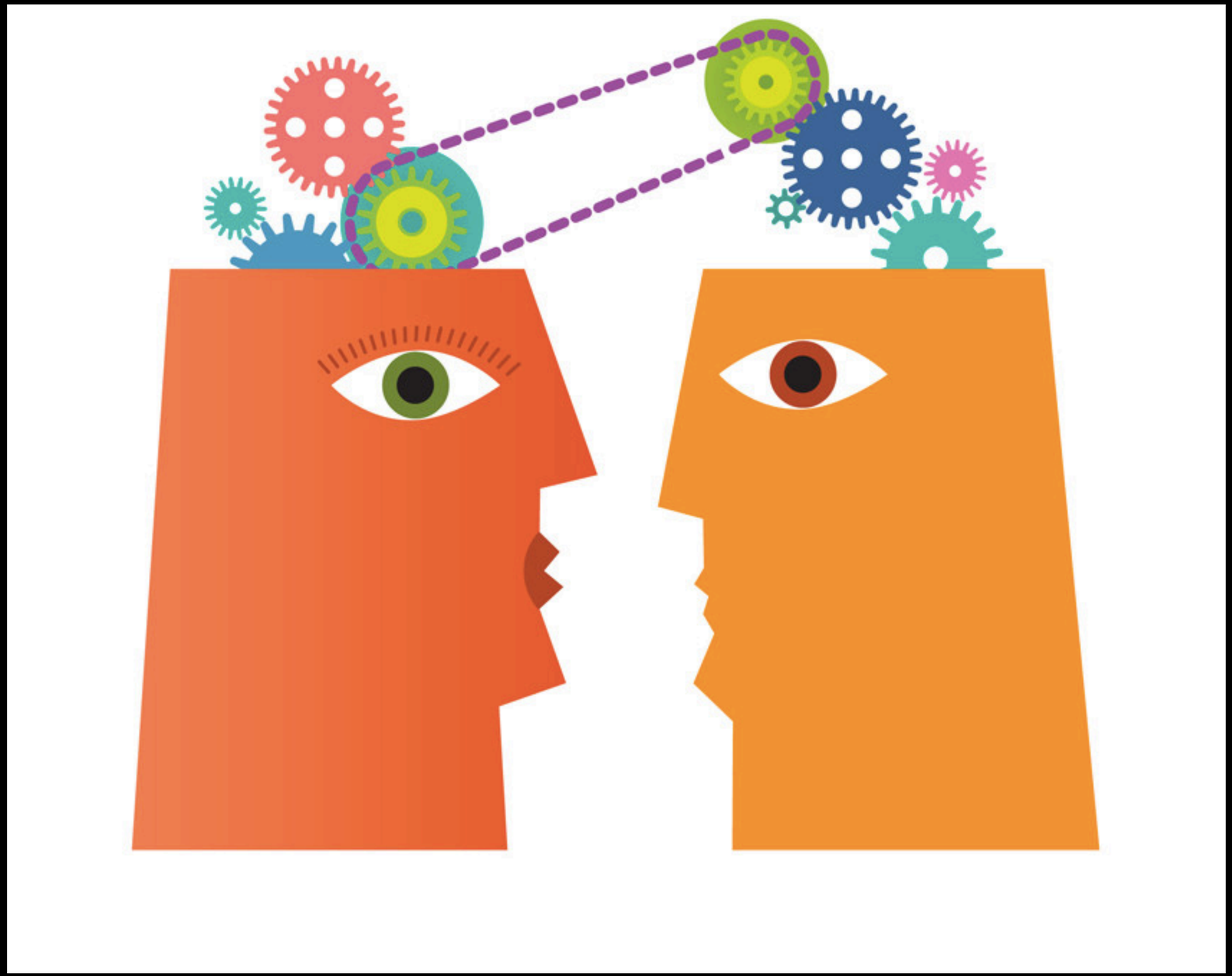
Daniel Thompson[1] · Sara Venturini[1] · Peter C. Whitfield[2] · Peter Hutchinson[1] · Nihal Gurusinghe[3] · Rikin Trivedi[1] · Adel Helmy[1] on behalf of the LP for SAH diagnosis research collaborative

10,187 patients

717 (7%) had LP after CT

55 (1%) after CT <6 hours





Bottom line

Consider SAH with sudden onset severe headache
Non contrast CT
LP or CTA

Recommendations for management

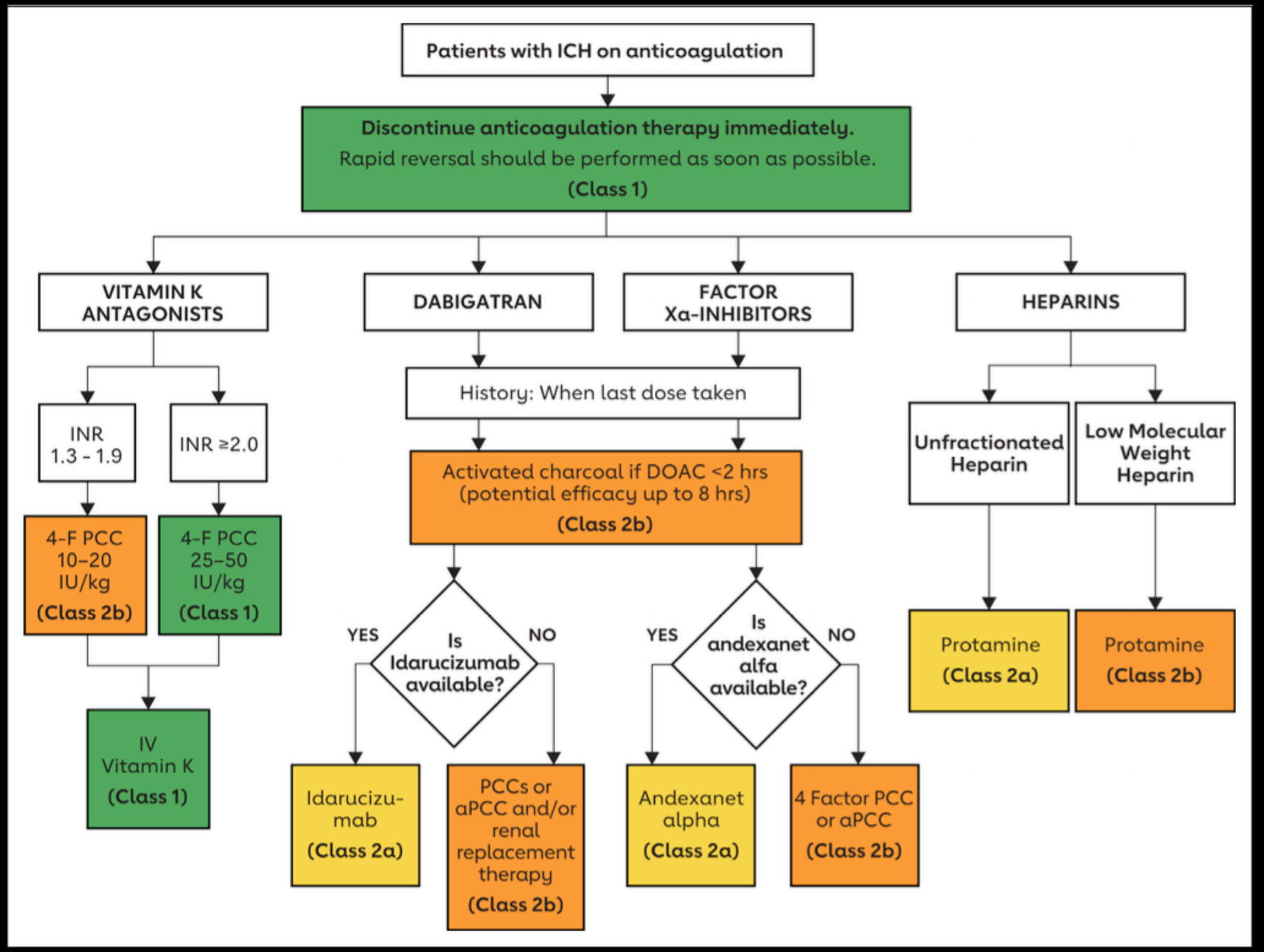
Control blood pressure
Reverse anticoagulation
Anti seizure medication
Consider ventriculostomy
Nimodipine
Consider antifibrinolytics

Recommendations for blood pressure management of SAH

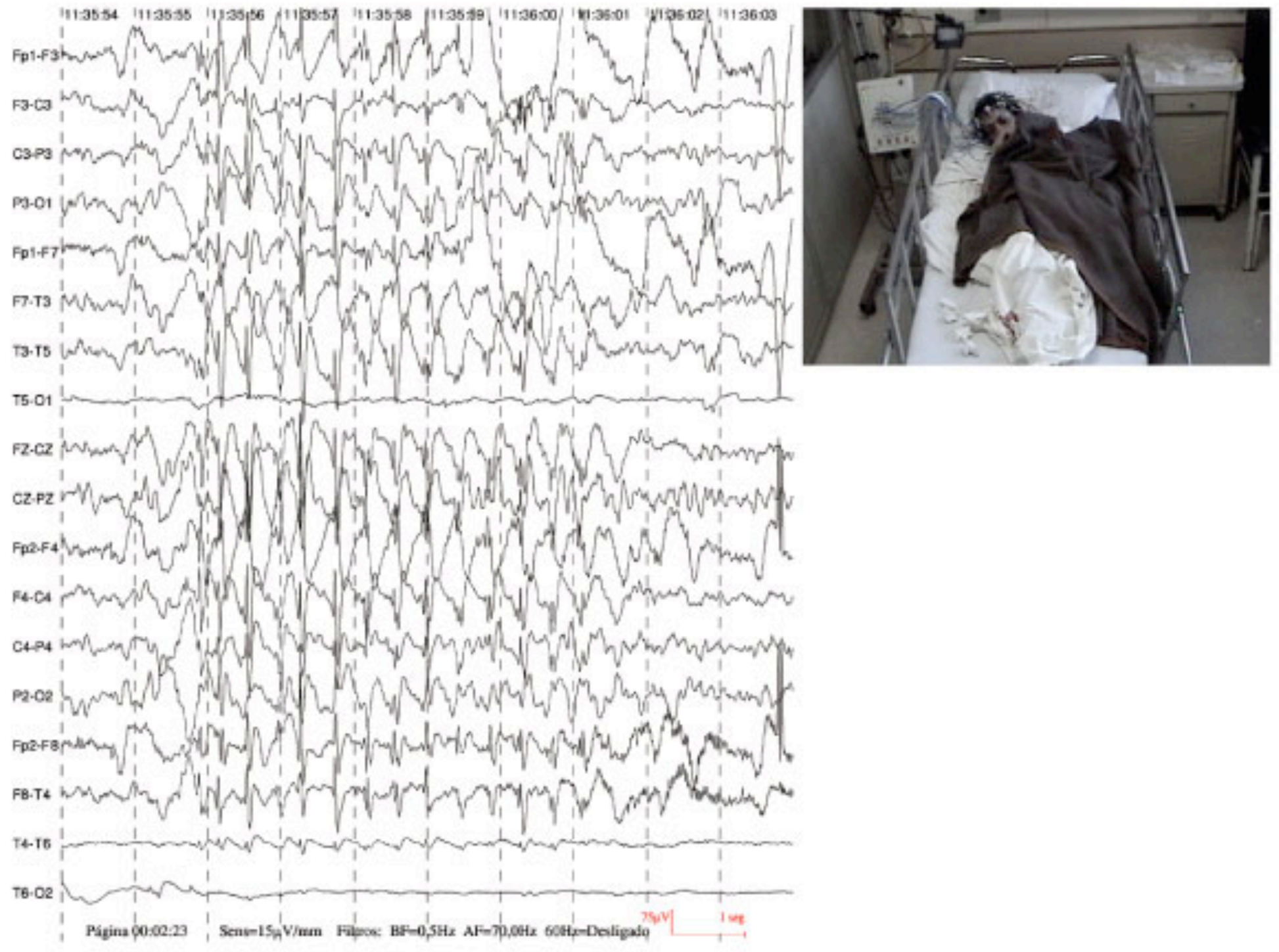
European Stroke Organization
SBP<180, maintain MAP>90

AHA/ASA
Gradual reduction if SBP > 180-200
Strict avoidance of MAP < 65

Neurocritical Care Society
Insufficient evidence to recommend



Greenberg *Stoke* 2022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Fp1-F3
F3-C3
C3-P3
P3-O1
Fp1-F7
F7-T3
T3-T5
T5-O1
FZ-CZ
CZ-PZ
Fp2-F4
F4-C4
C4-P4
P2-O2
Fp2-F8
F8-T4
T4-T6
T6-O2
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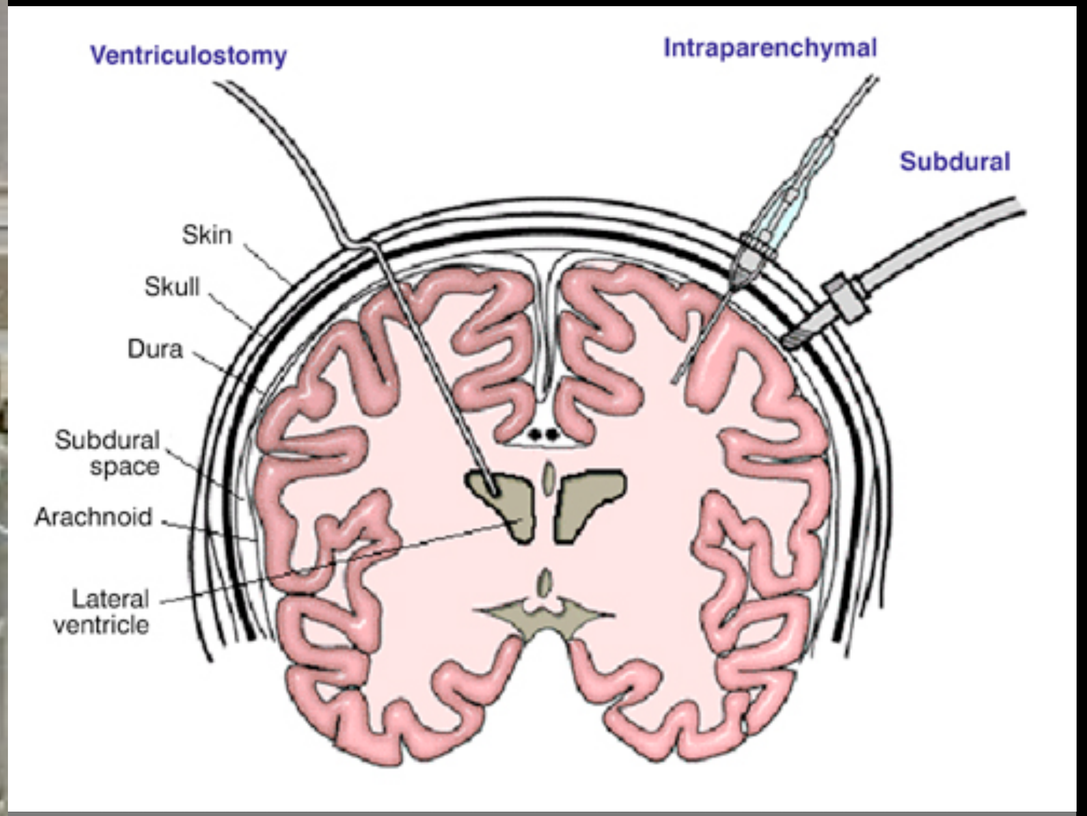
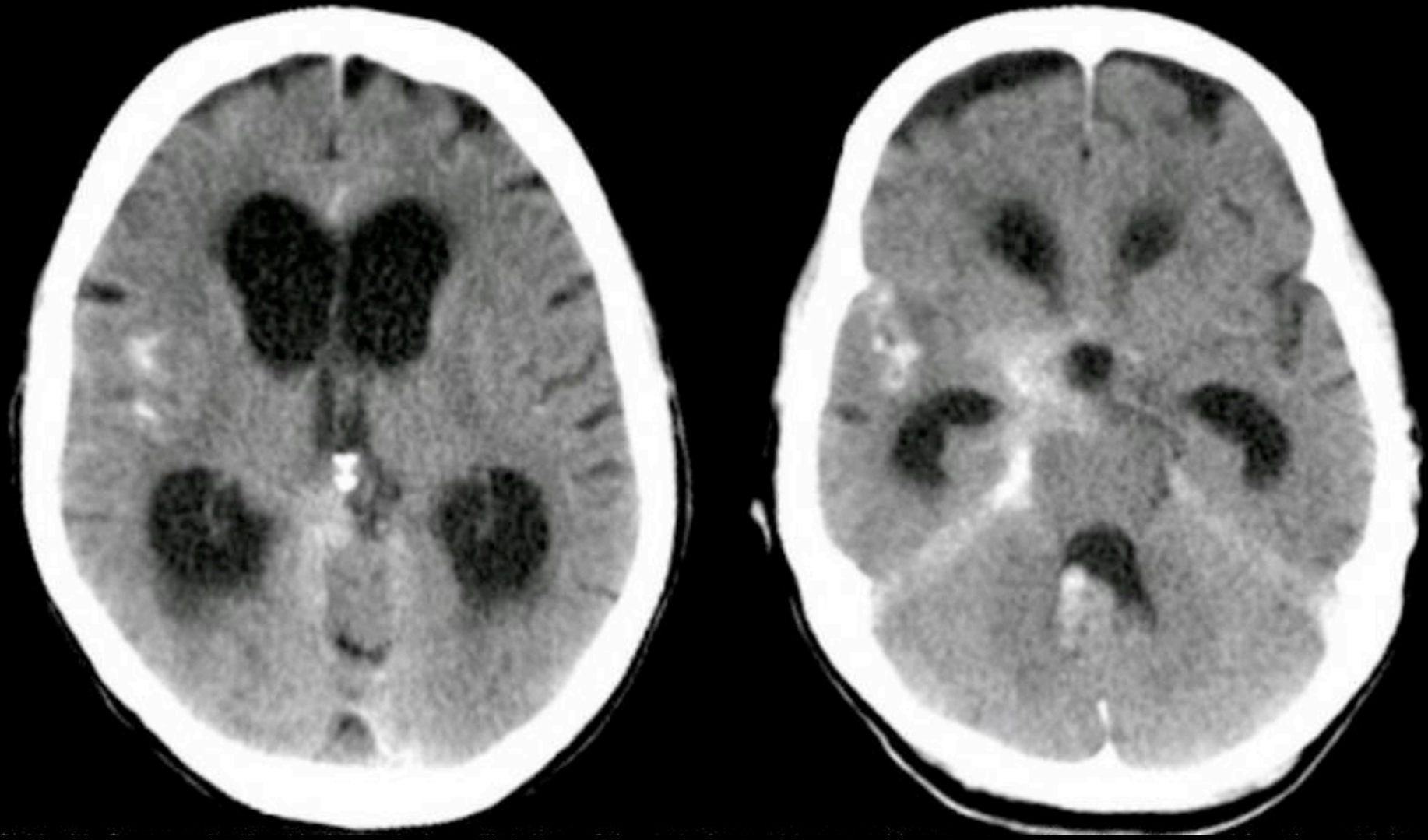
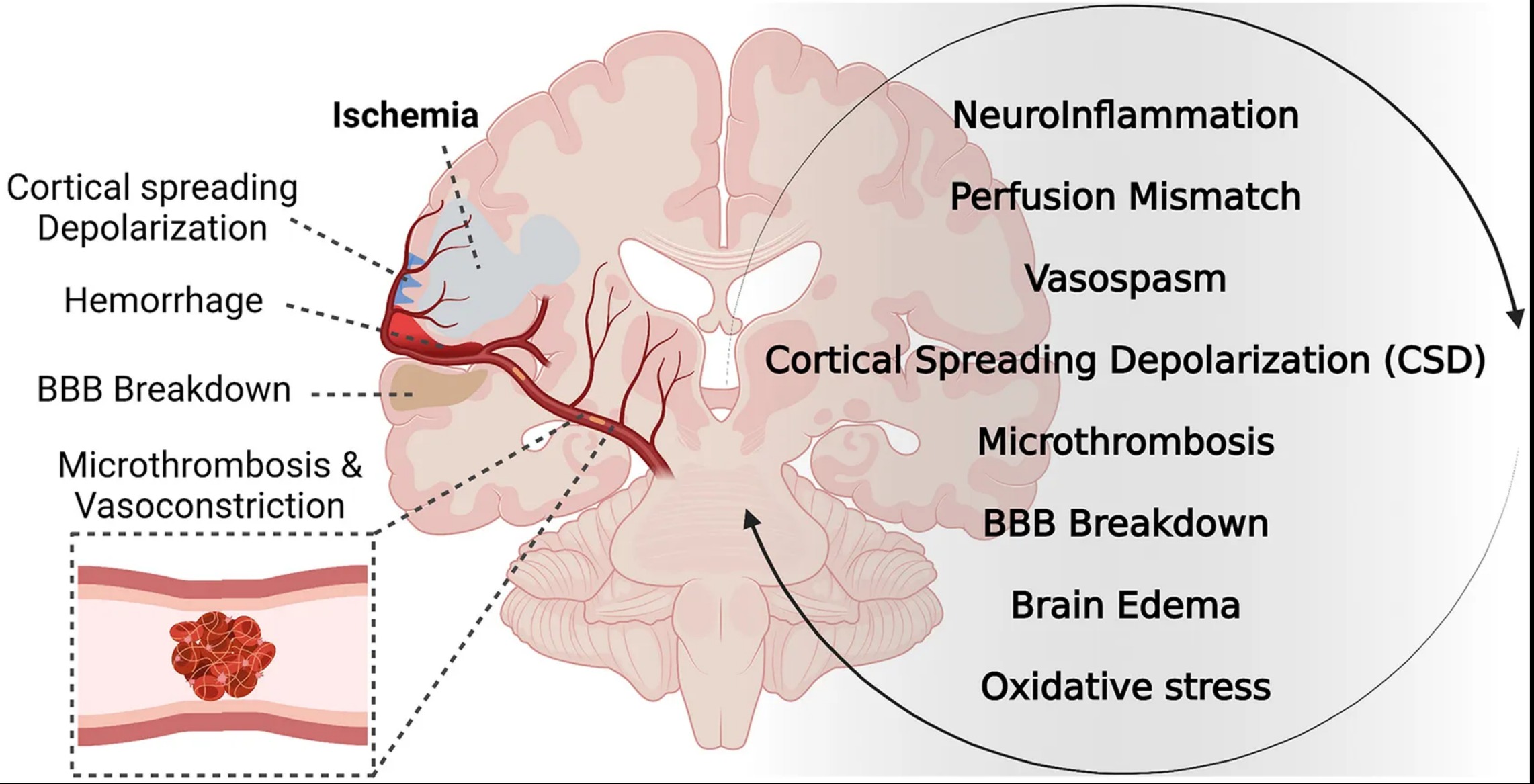
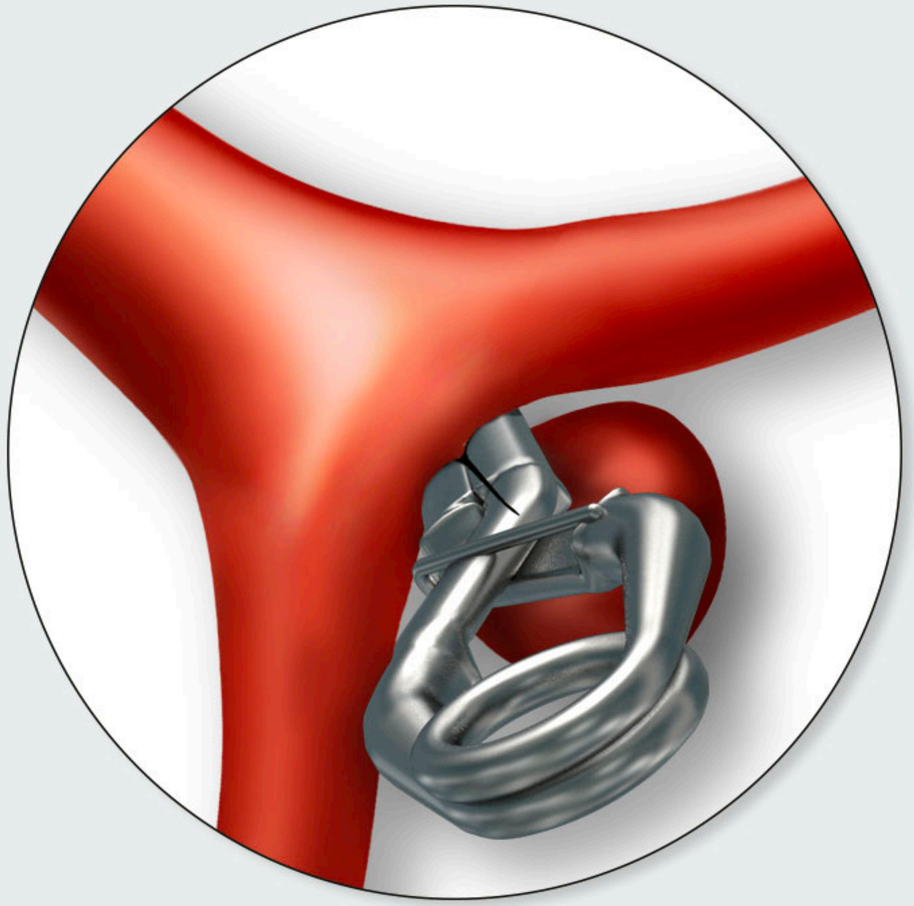

Ventriculostomy
Intraparenchymal
Subdural
Skin
Skull
Dura
Subdural space
Arachnoid
Lateral ventricle



Pathophysiology of Delayed Cerebral Ischemia after SAH





Clipping

Coiling

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Thank you

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