Subarachnoid Hemorrhage

Diagnosis and Acute Management

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I have no disclosures

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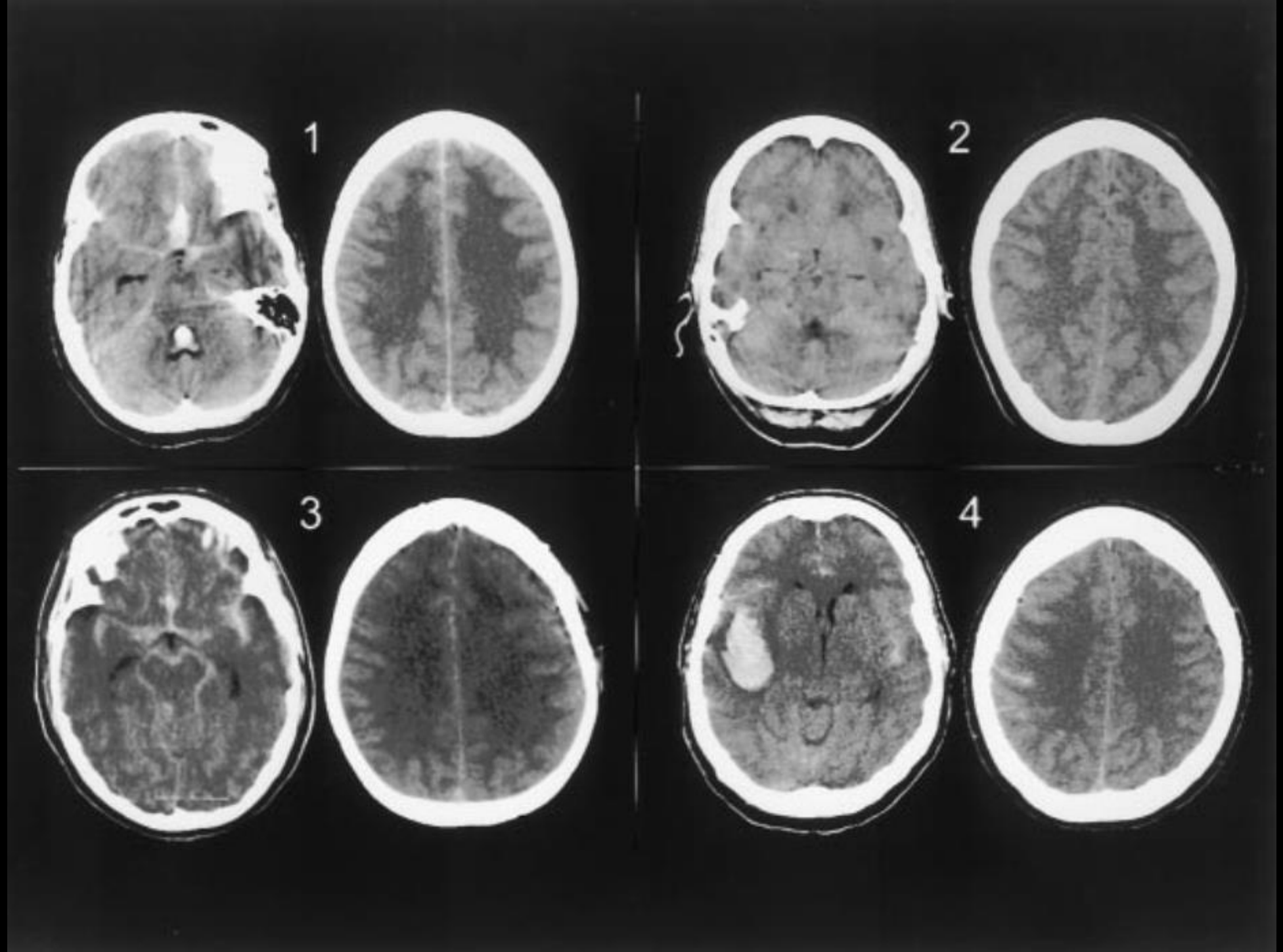
Department of Emergency Medicine
DARTMOUTH HITCHCOCK MEDICAL CENTER

HA = 1% of Emergency Department visits
SAH = 1% of HA (10/100,000)
50% = normal exam
85% SAH = non-traumatic
80% = aneurysmal
10% = perimesencephalic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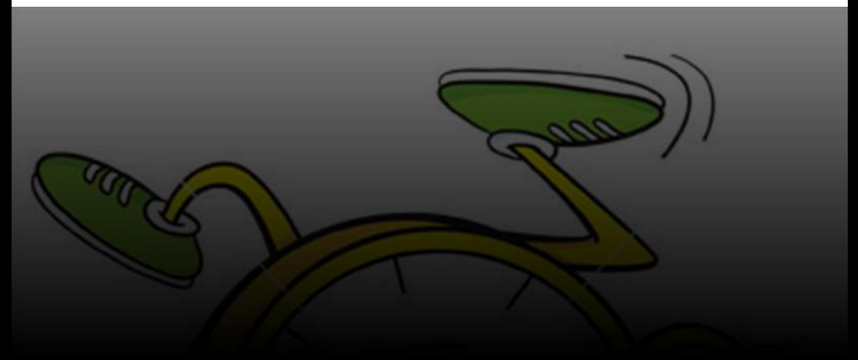
2
3
4

Clinical outcome at 12 months.

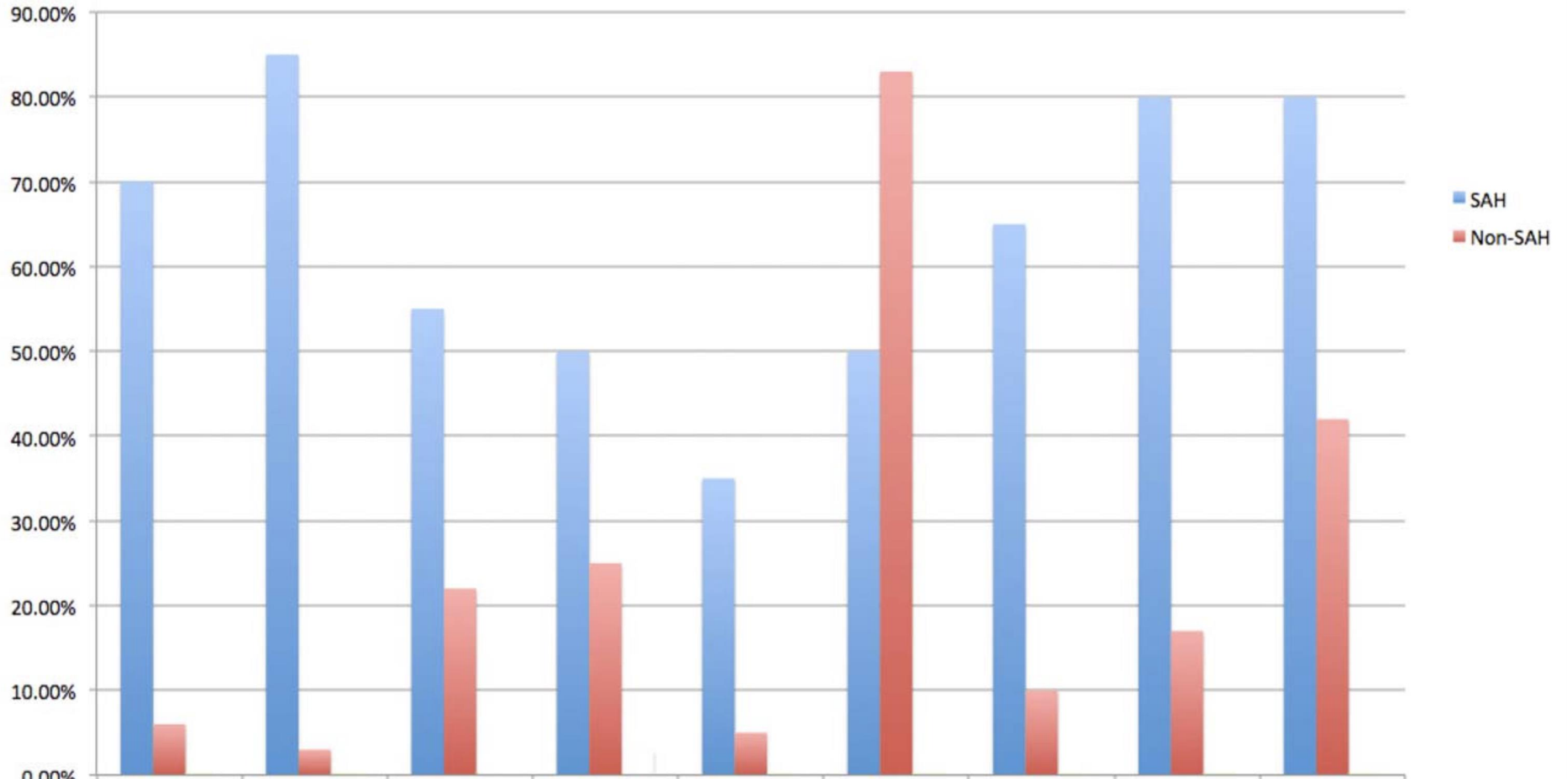
Outcomes	Rebleeding (n = 30)	No rebleeding (n = 267)	p value
mRS 0–2	2 (6.7%)	118 (44.1%)	<0.001
mRS 3	0	11 (4.1%)	0.610
mRS 4–5	1 (3.3%)	29 (10.9%)	0.328
Death	26 (86.7%)	108 (40.4%)	<0.001
Lost to follow-up	1 (3.3%)	1 (0.5%)	0.483

Zhao J Neurolog Sciences 2016



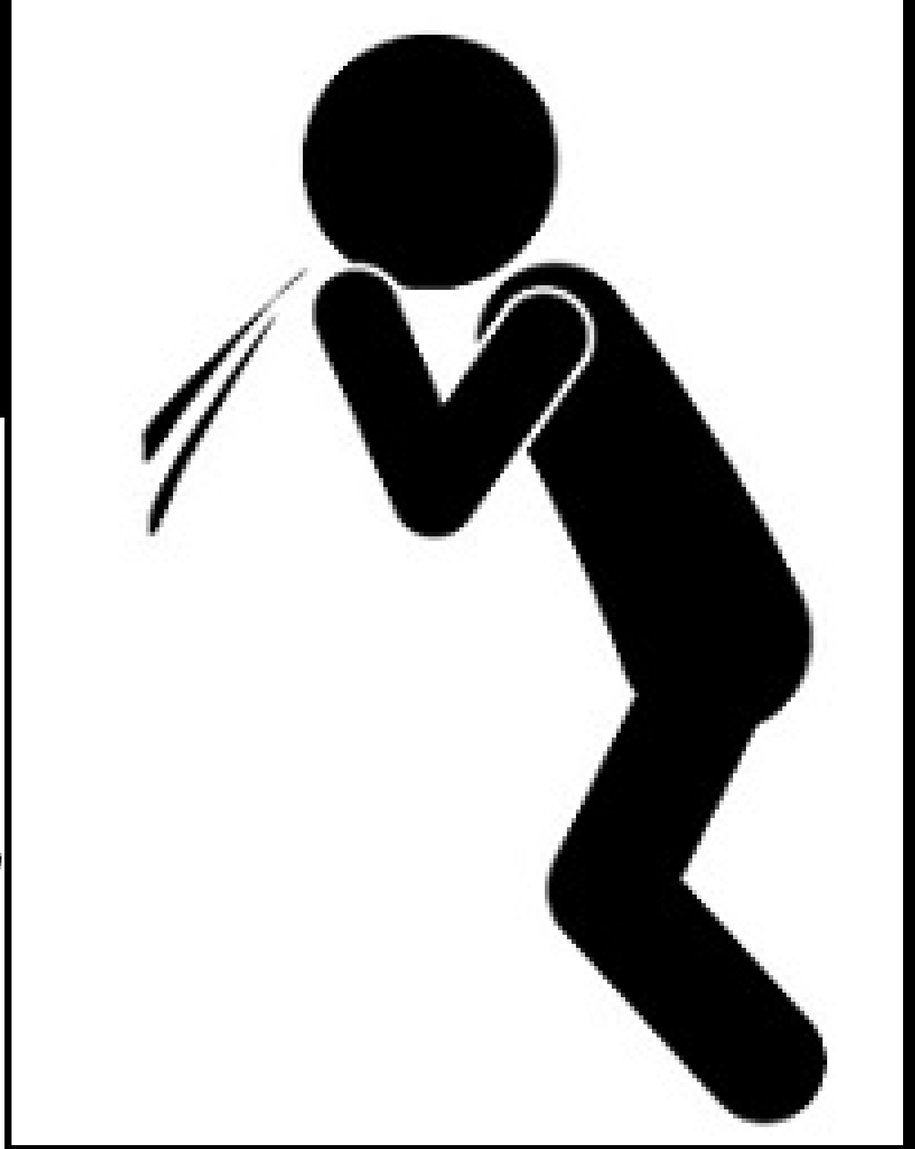

HEADACHE
This sucks.

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

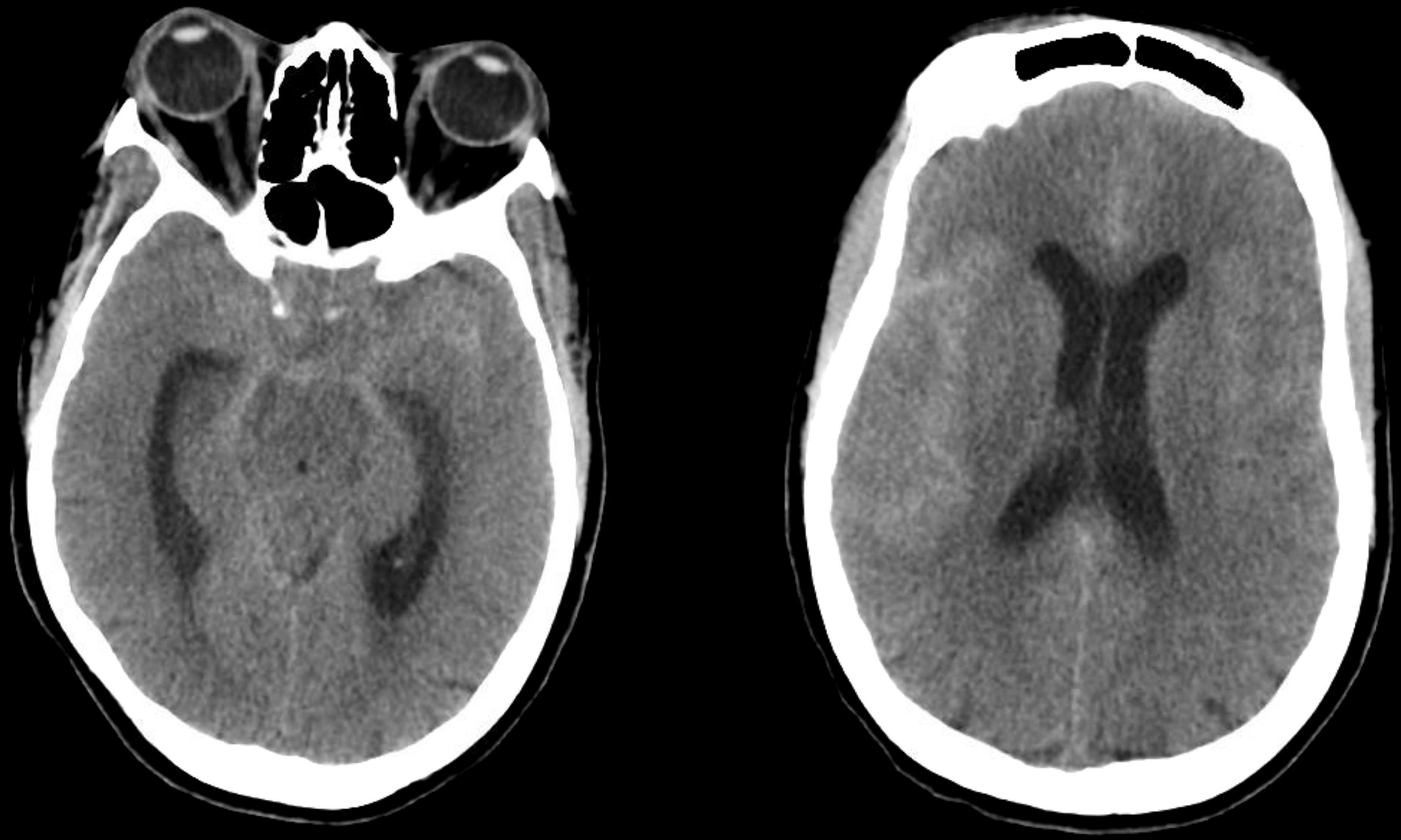
Dissection

Vasculitis

Meningitis

AVM

RCVS



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 Page 1 of 10

RESEARCH

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

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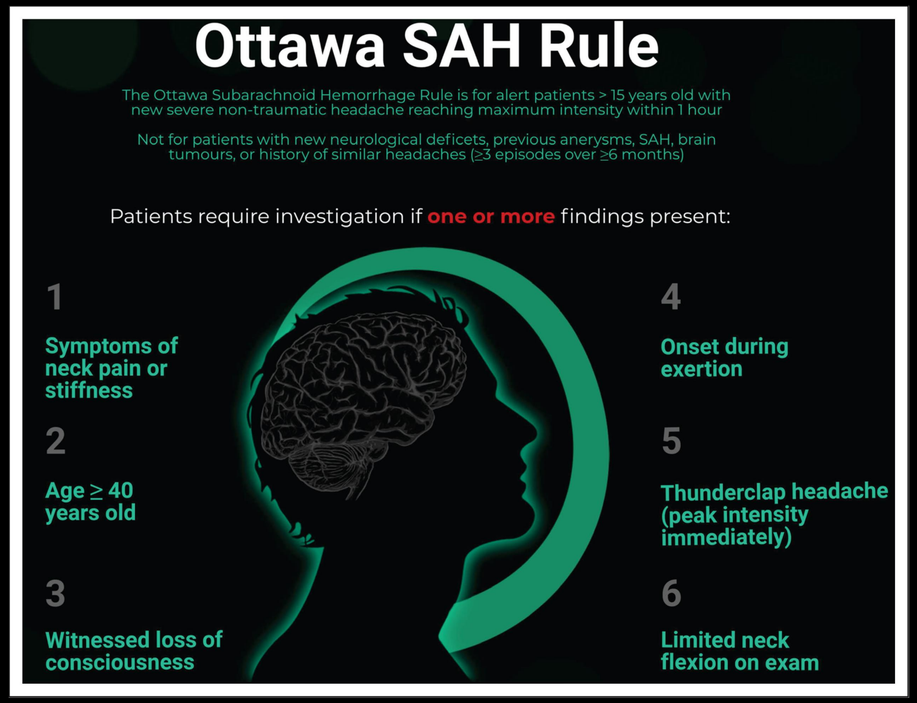

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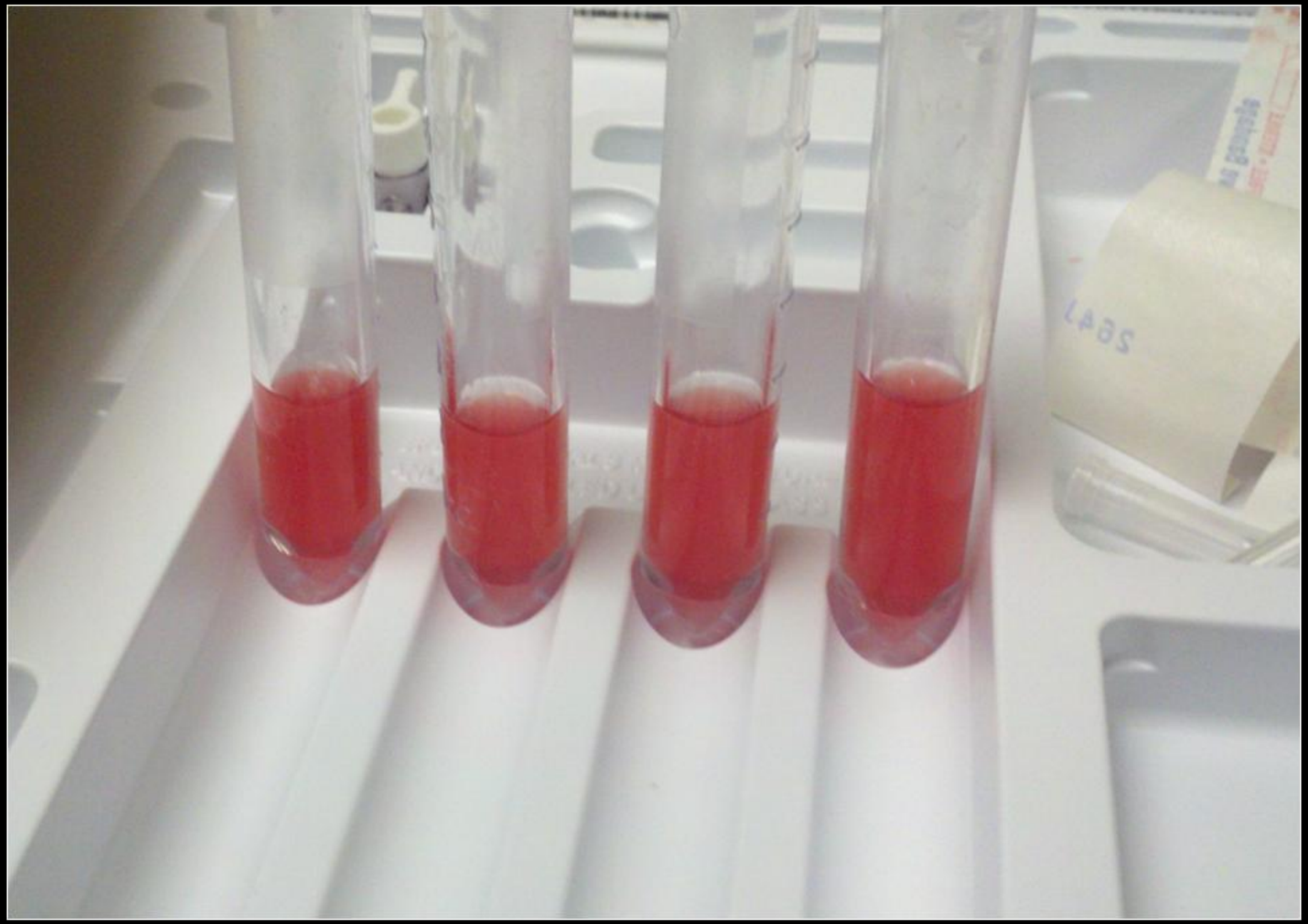
	SAH	
	Yes	No
6-h CT rule (N=1204)		
Positive	106	0
Negative	5	1093
Sensitivity (95% CI)	95.5 (89.8–98.5)	
Specificity (95% CI)	100.0 (99.7–100.0)	
Ottawa SAH rule (N=3672)		
High risk	188	3040
Low risk	0	444
Sensitivity (95% CI)	100.0 (98.1–100.0)	
Specificity (95% CI)	12.7 (11.7–13.9)	

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?

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

3. **In the adult ED patient presenting with acute headache, does a normal noncontrast head CT scan performed within 6 hours of headache onset preclude the need for further diagnostic workup for SAH?**

Level C recommendations. None specified.

Potential Benefit of Implementing the Recommendations:

- Selected patients will no longer need to be subjected to LP or CTA as a part of ruling out an SAH.

Potential Harm of Implementing the Recommendations:

- In the evaluation of ED headache, LP after a normal head CT is a long-standing diagnostic regimen that will occasionally reveal alternative diagnoses. If the LP is no longer performed, these diagnoses may be missed, particularly in patients for whom other diagnoses remain in the differential, eg, meningitis.
- The use of the recommendation could result in a rare missed SAH.

Wolf *Ann Emerg Med* 2019

4. **In the adult ED patient who is still considered to be at risk for SAH after a negative noncontrast head CT, is CTA of the head as effective as LP to safely rule out SAH?**

Level C recommendations. Perform LP or CTA to safely rule out SAH in the adult ED patient who is still considered to be at risk for SAH after a negative noncontrast head CT result.

Use shared decision making to select the best modality for each patient after weighing the potential for false-positive imaging and the pros and cons associated with LP.

Potential Benefit of Implementing the Recommendations:

- This has the benefit of avoiding the performance of LP, a procedure that is time consuming, has a low diagnostic yield, has a high rate of traumatic taps, has a high rate of uninterpretable test results, and is associated with a relatively high rate of post-LP headaches.

Potential Harm of Implementing the Recommendations:

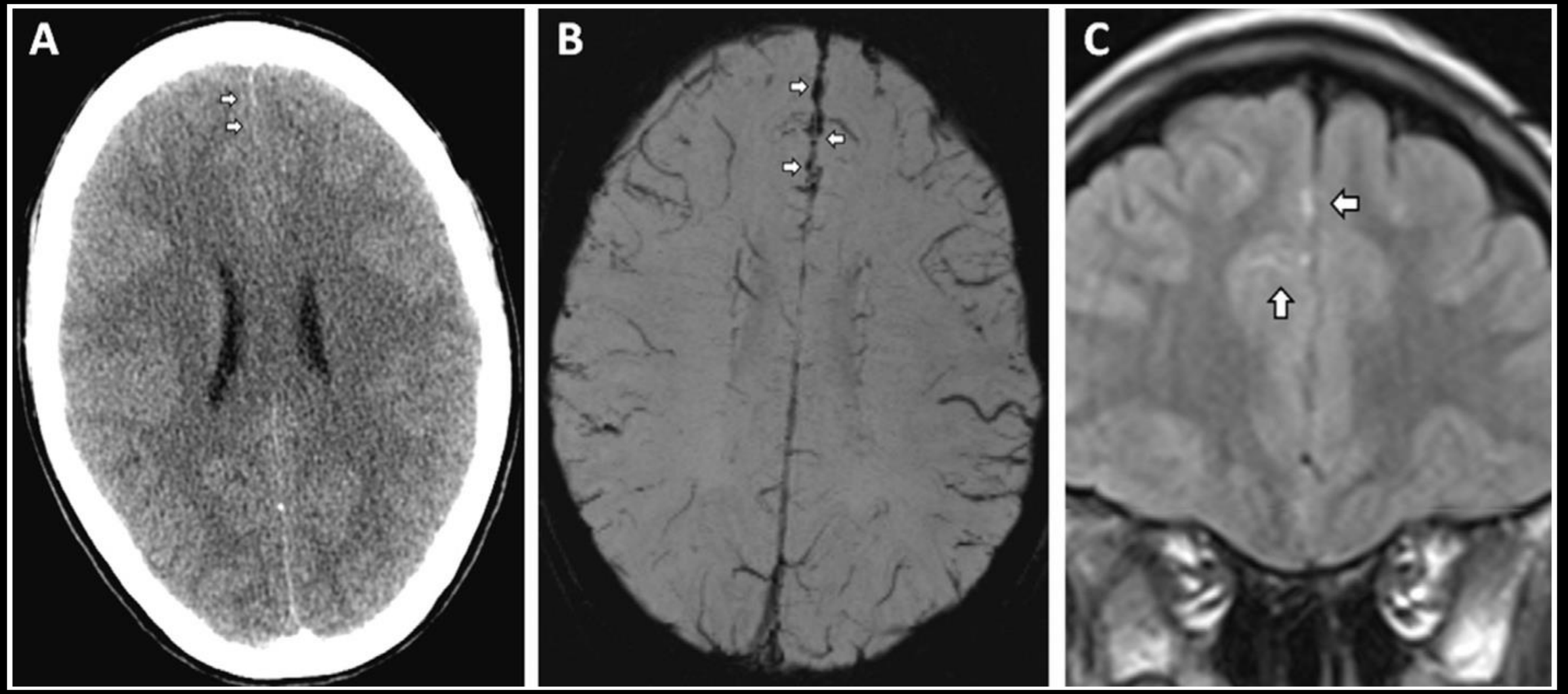
- The use of CTA may identify incidental cerebral aneurysms that lead to an unnecessary invasive procedure. In addition, there is increased radiation exposure and the potential to miss alternative medical diagnoses that would have been made by LP.
- The ease of ordering CTA may increase the rate of testing.

Wolf *Ann Emerg Med* 2019

AHA/ASA

1	B-NR	2. In patients with acute onset of severe headache who present >6 hours from symptom onset or who have a new neurological deficit, a noncontrast head CT and, if negative for aSAH, lumbar puncture (LP) should be performed to diagnose/exclude aSAH.[47,48]
2a	B-NR	3. In patients with acute onset of severe headache who present <6 hours from symptom onset and without new neurological deficit, a noncontrast head CT performed on a high-quality scanner and interpreted by a board-certified neuroradiologist is reasonable to diagnose/exclude aSAH.[49–53]

Hoh *Stroke* 2023


A
B
C

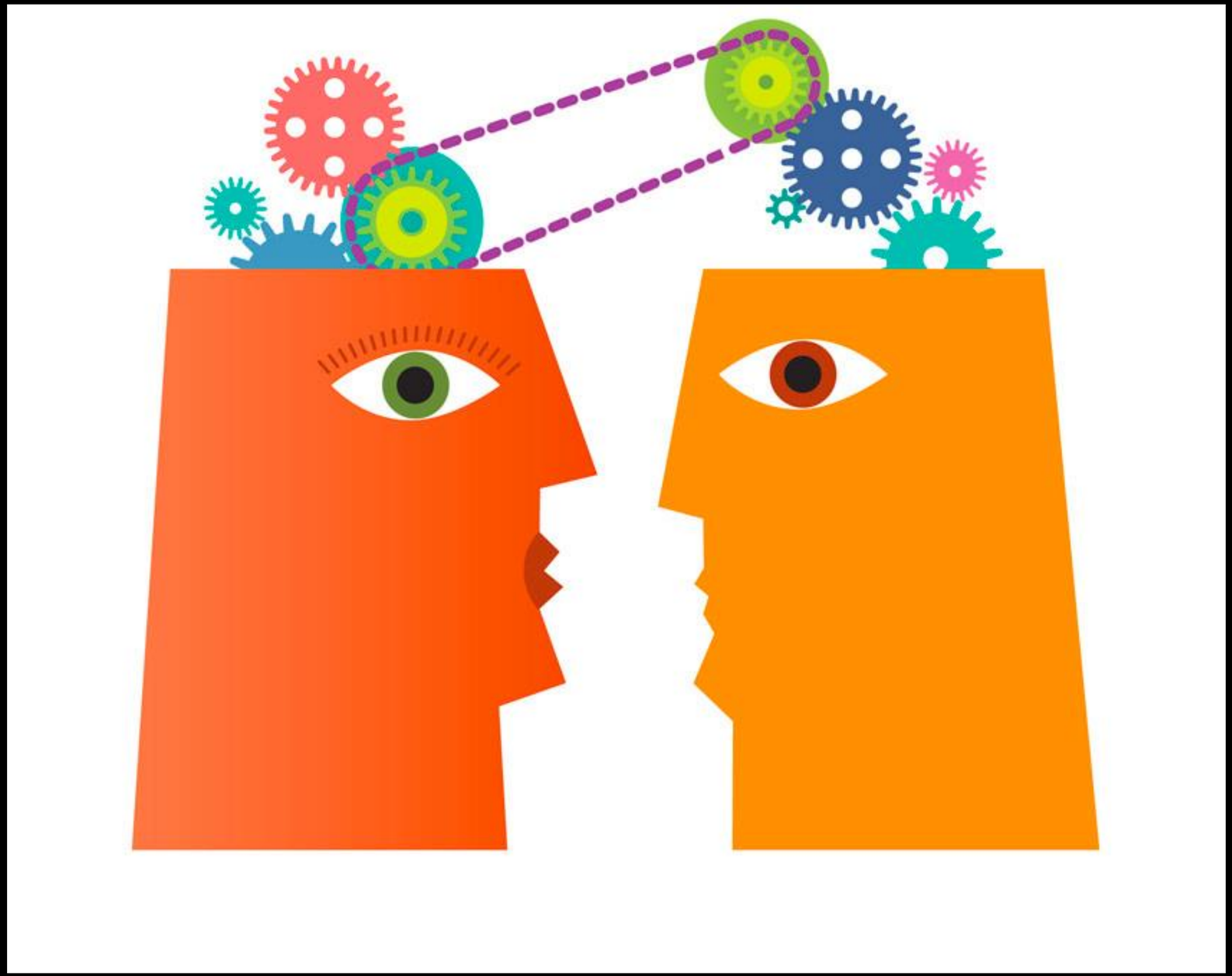
European Stroke Organization Guidelines for the Management of Intracranial Aneurysms and Subarachnoid Haemorrhage

Thorsten Steiner[a] Seppo Juvela[d] Andreas Unterberg[b] Carla Jung[b]
Michael Forsting[c] Gabriel Rinkel[e]

Recommendation for Diagnosis

- CT/CTA and MRI with multiple sequences are equally suitable for the diagnosis of SAH within 24 h (class II, level B)
- CT/CTA and multisequential MRI/MRA may confirm the underlying cause
- Lumbar puncture must be performed in a case of clinically suspected SAH if CT or MRI does not confirm the diagnosis (class II, level B); however, within the first 6–12 h the differentiation between genuine subarachnoidal blood and traumatic admixture of blood may be difficult
- DSA of all cerebral arteries should be performed if a bleeding source was not found on CTA and the patient has a typical basal SAH pattern on CT (class II, level B)
- If no aneurysm was found, CTA or DSA should be repeated as described below: SAH without aneurysm (class III, level C)

Steiner *Cerebrovasc Dis* 2013



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
SBP<160, maintain MAP>90

Neurocritical Care Society
Insufficient evidence to recommend


11:35:54
11:35:55
11:35:56
11:35:57
11:35:58
11:35:59
11:36:00
11:36:01
11:36:02
11:36:03
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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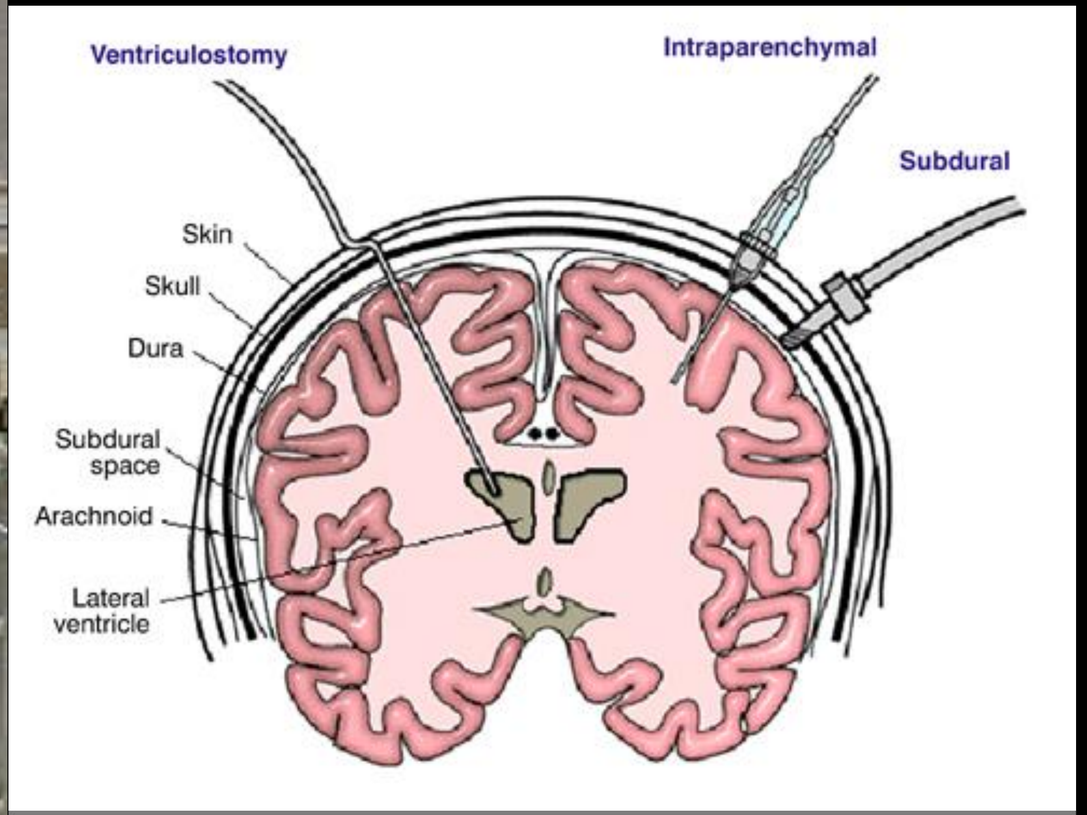
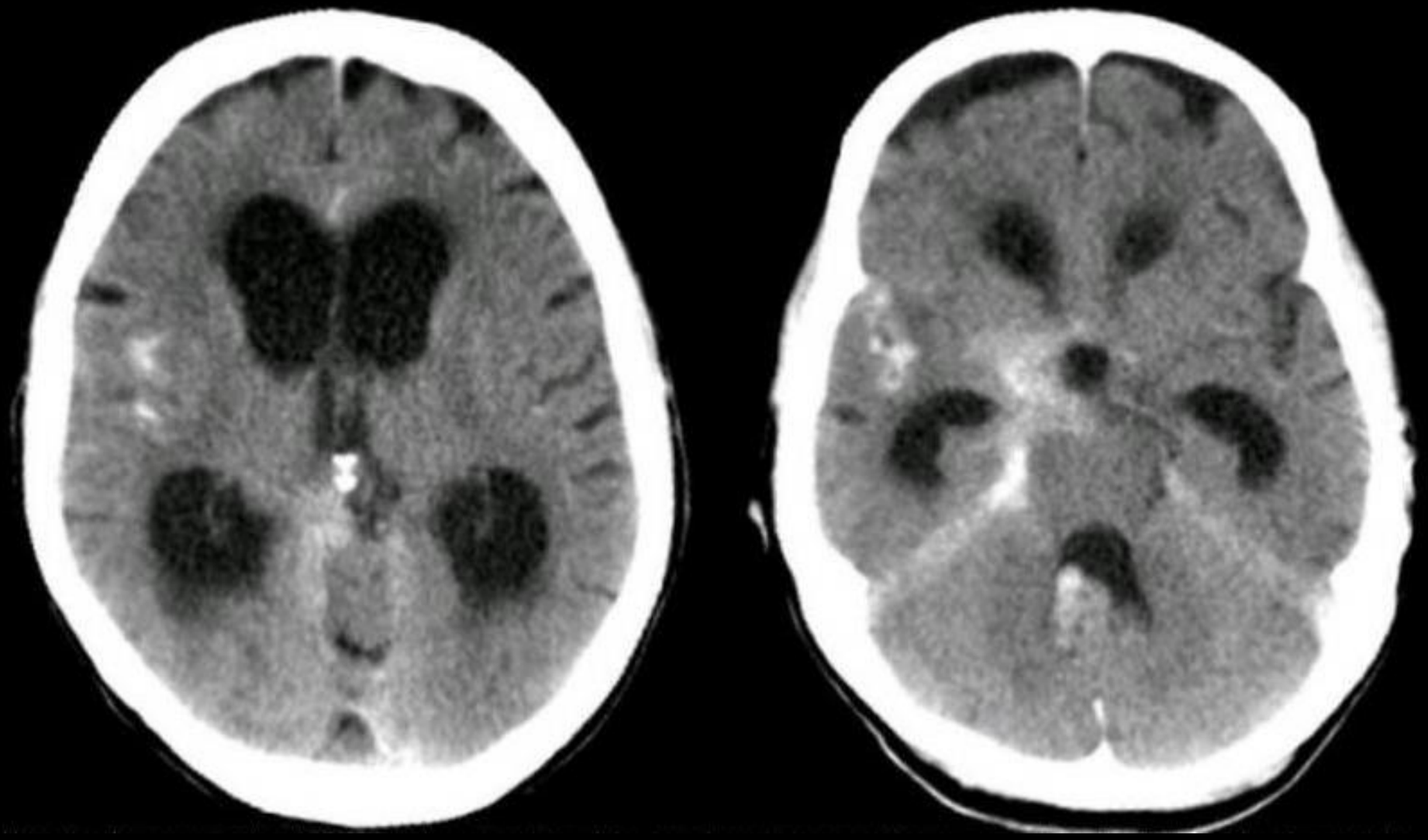
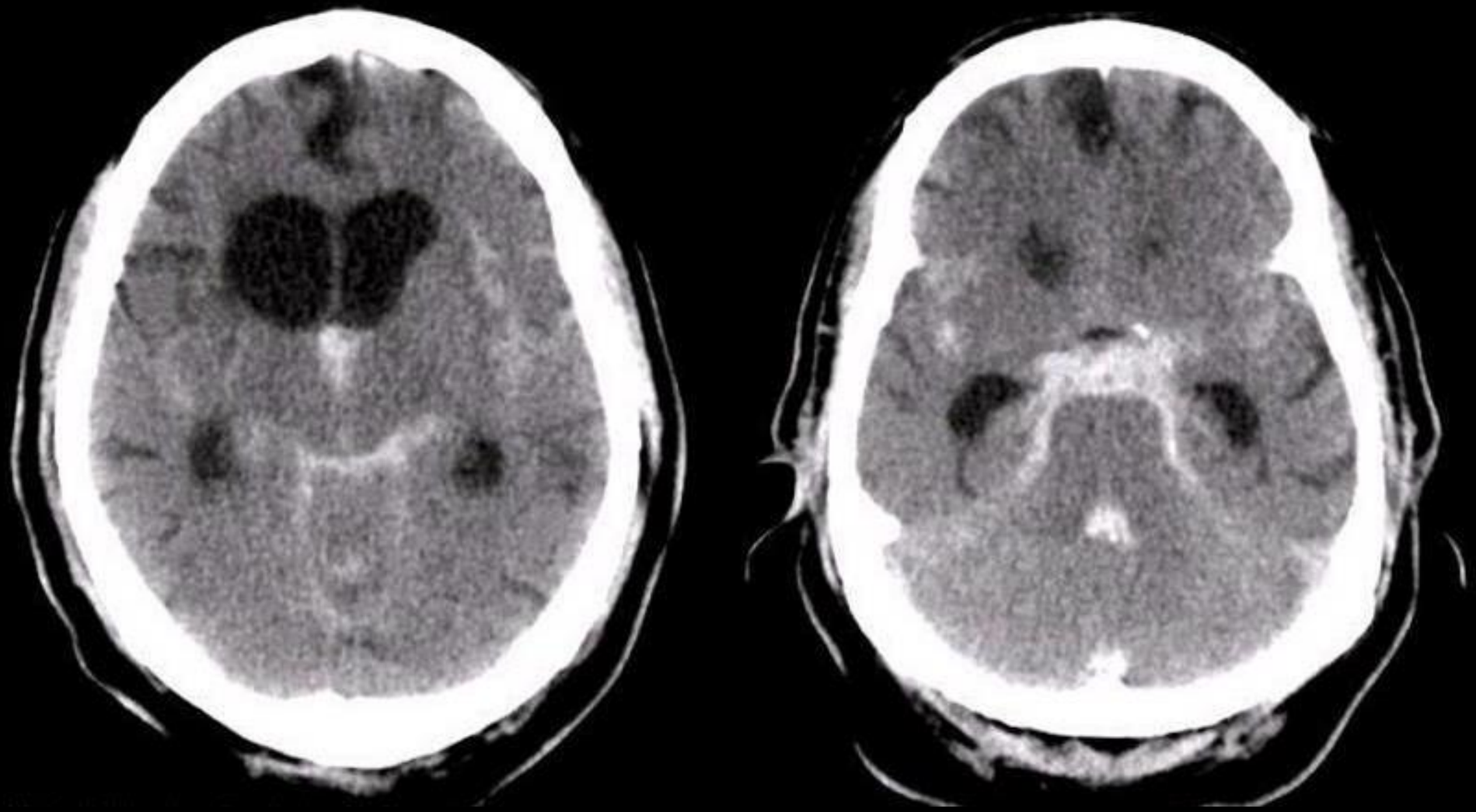

Ventriculostomy
Intraparenchymal
Subdural
Skin
Skull
Dura
Subdural space
Arachnoid
Lateral ventricle

Communicating hydrocephalus



Non-Communicating hydrocephalus



Score	Fisher Scale	Modified Fisher Scale[a]	Claassen Scale[b]	BNI Grading Scale[c]	Hijdra Sum Score[d]
0		No SAH or IVH	No SAH or IVH		No blood
1	No blood detected	Focal or diffuse, thin SAH, no IVH	Minimal/thin SAH, no IVH in both lat ventricles	No visible SAH	Sedimentation of blood
2	Diffuse deposition of thin layer w/all vertical layers of blood <1 mm thick	Focal or diffuse, thin SAH, w/IVH	Minimal/thin SAH, w/IVH in both lat ventricles	Max SAH thickness ≤5 mm	Partly filled with blood
3	Vertical layers of blood ≥1 mm thick or localizes clots (clots defined as >3×5 mm)	Focal or diffuse, thick SAH, no IVH	Thick SAH, no IVH in both lat ventricles	Max SAH thickness >5 mm to 10 mm	Completely filled with blood
4	Diffuse or no subarachnoid blood, but w/intracerebral or intraventricular clots	Focal or diffuse, thick SAH, w/IVH	Thick SAH, w/IVH in both lat ventricles	Max SAH thickness >10 mm to 15 mm	
5				Max SAH thickness >15 mm	

BNI, Barrow Neurological Institute.

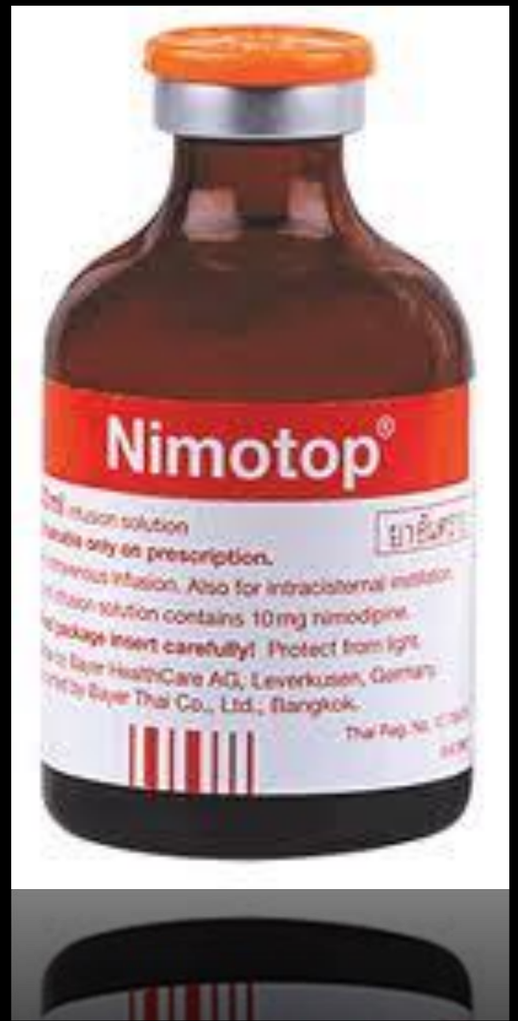
[a]Definition of thin or thick not specified.

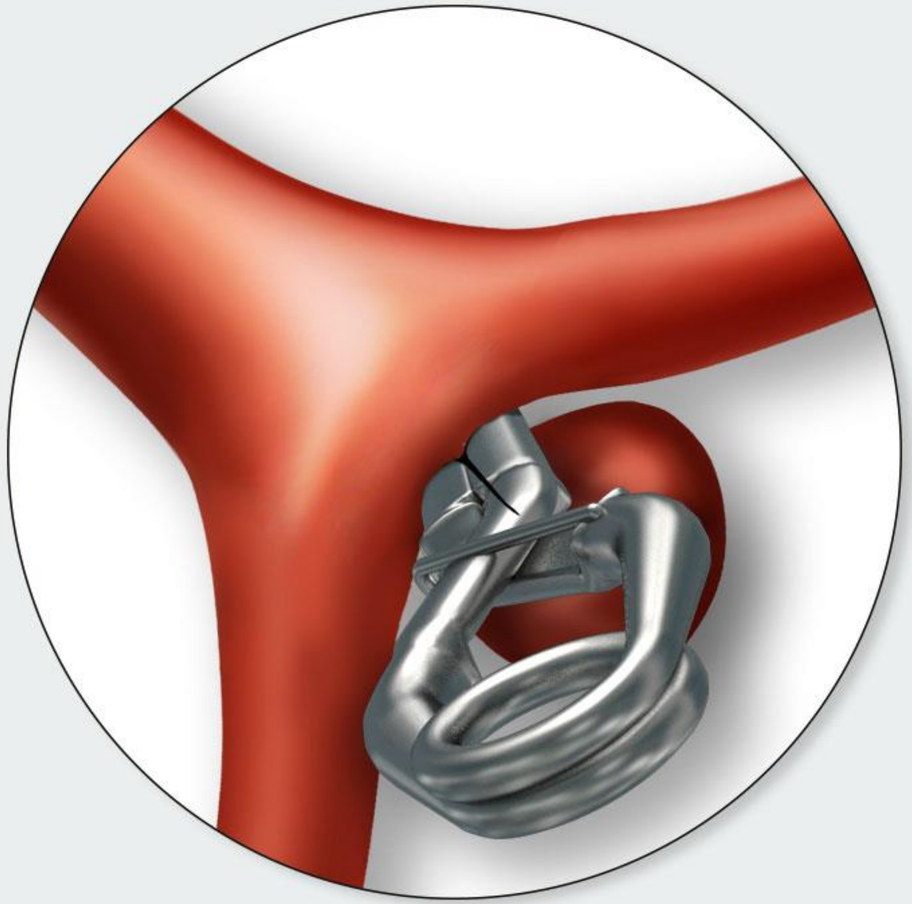
[b]Definition of thick is completely filling ≥1 cistern or fissures.

[c]Thickness measured perpendicular to course of cistern.

[d]Total amount of blood is calculated by adding individual scores within 10 subarachnoid cisterns and 4 ventricles.

Treatment


Nimotop®
Bayer HealthCare AG, Leverkusen, Germany
Bayer Thai Co., Ltd., Bangkok.



Clipping

Coiling

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Thank you

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