Brain Bleeds
Treatment Options
&
~~Special~~ Surgical Considerations

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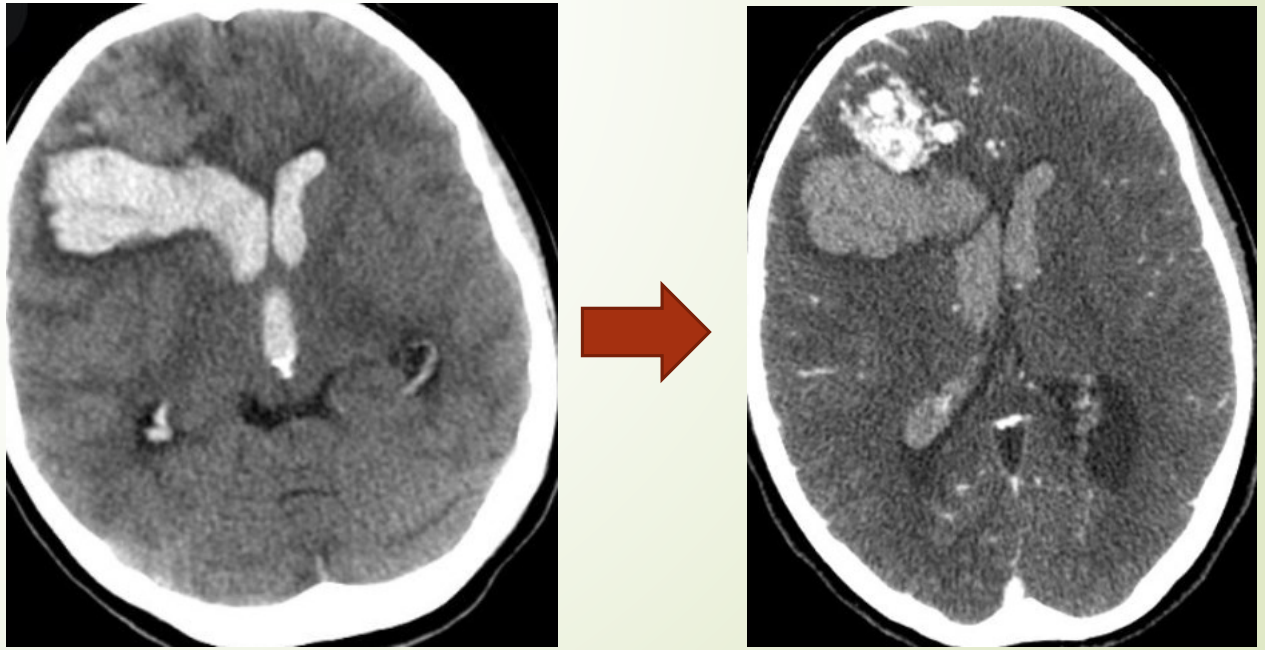
RUSH Conference 6/22/2022

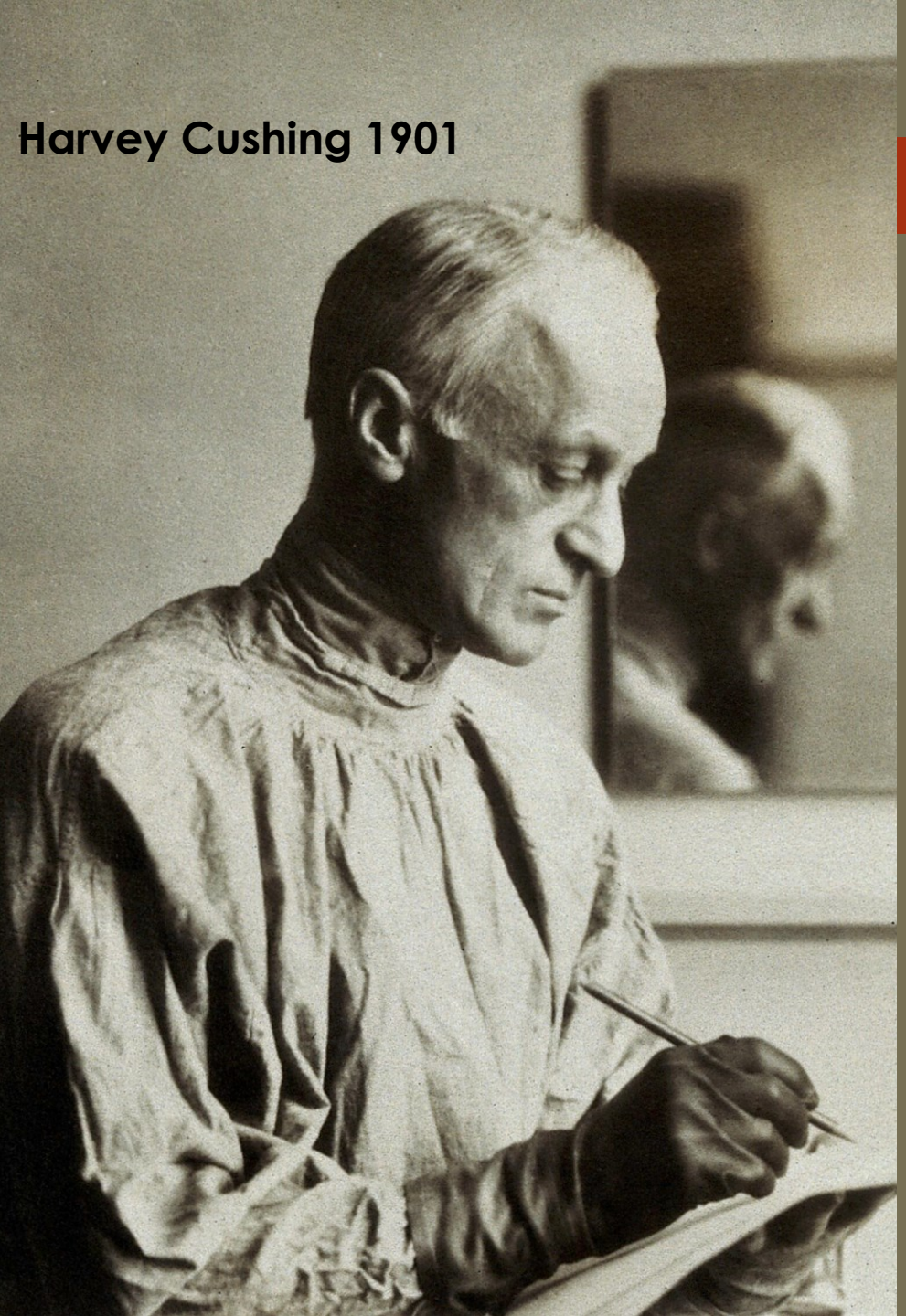
Case

- 64 year old male with PMHx of colon adenocarcinoma s/p chemoradiation, deep venous thrombosis on therapeutic Lovenox and ASA 81mg presenting via EMS after being found down at the bottom of the stairs. Last known well 12 hours from arrival.



Rules of 👍 for all Intracranial Hemorrhage

- ABCDs
- **Neurological exam: i.e: Glasgow Coma Scale or NIHSS; focal exam or seizure?**
- Labs (CBC and INR/PTT)
- Hx of Antiplatelet/Anticoagulant agents
- CT head without contrast
  - CT angiography head and neck
- Trauma assessment?
- Neurological ICU
- Neurological Surgery
  - Surgical Intervention or not
- Are there management guidelines?



Harvey Cushing 1901

Rule: ABC

- Check and secure the airway
- Assess for agonal breathing, sonorous breaths, Cheyne-stoke pattern
- Cushing reflex of bradycardia and hypertension
  - Elevated ICP-> ischemia->sympathetic response and baroreceptor
- CPP: MAP-ICP (>50)

NIHSS

Neurological exam

TABLE 38-2

Glasgow Coma Scale

BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1
Total score:	*Best response*	15
	Comatose client	8 or less
	Totally unresponsive	3

Hunt Hess Grade

TABLE 1

Classification of patients with intracranial aneurysms according to surgical risk

Category*	Criteria
Grade I	Asymptomatic, or minimal headache and slight nuchal rigidity.
Grade II	Moderate to severe headache, nuchal rigidity, no neurological deficit other than cranial nerve palsy.
Grade III	Drowsiness, confusion, or mild focal deficit.
Grade IV	Stupor, moderate to severe hemiparesis, possibly early decerebrate rigidity and vegetative disturbances.
Grade V	Deep coma, decerebrate rigidity, moribund appearance.

Lab work, Blood thinners, Reversal Agents

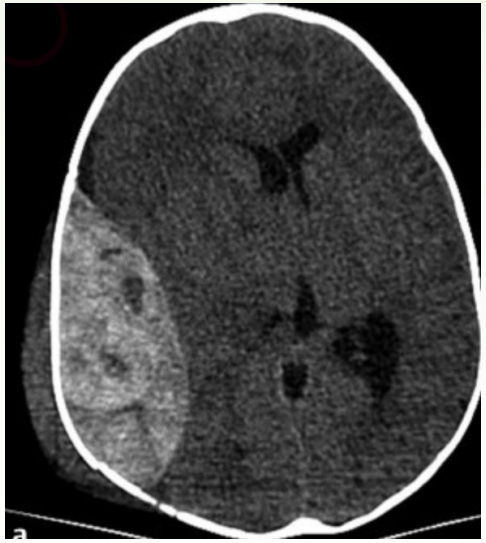
- Platelet
- Coagulation Panel
- Adjuvant labwork
  - Anti Xa
  - Verify Now P2Y12 assay

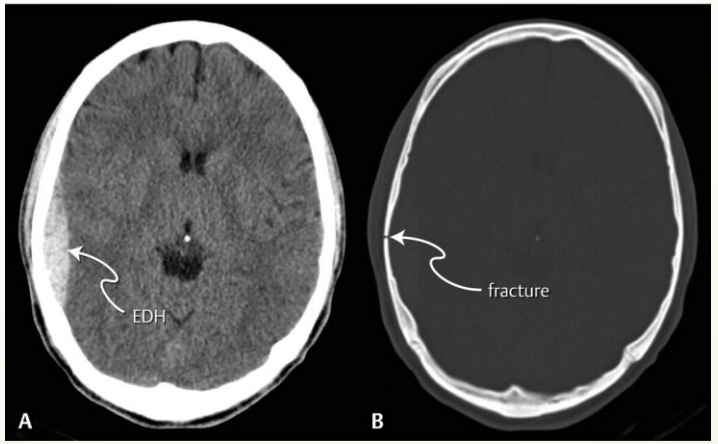
Antiplatelet	Anticoagulant		
ASA Plavix Brilinta Cangrelor Eptifibatide Dipyramidole	Coumadin	Eliquis Xarelto Pradaxa	Heparin Lovenox Fondaparinux
Desmopressin **platelets**	**Vitamin K** **PCC** **FFP**	**Andexxa** **Praxbind** **Idarucizumab**	**Protamine**

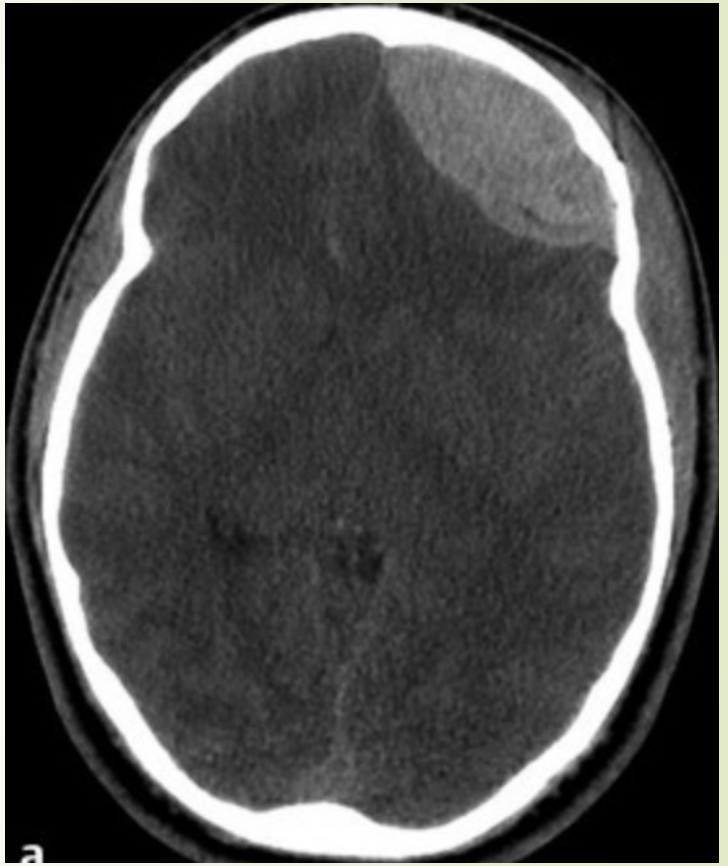
The CT head without contrast

Epidural Hematoma

- Volume >30 cm^3
- Relative
  - Exam (GCS/Anisocoria)
  - < 30
  - >15mm
  - Mass effect
  - Fracture





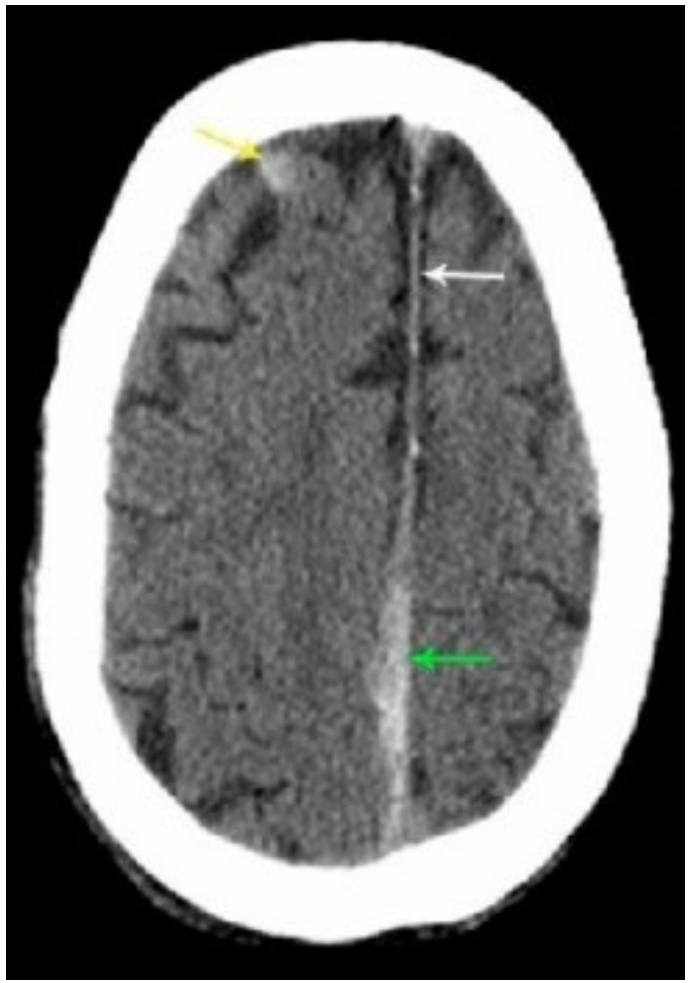


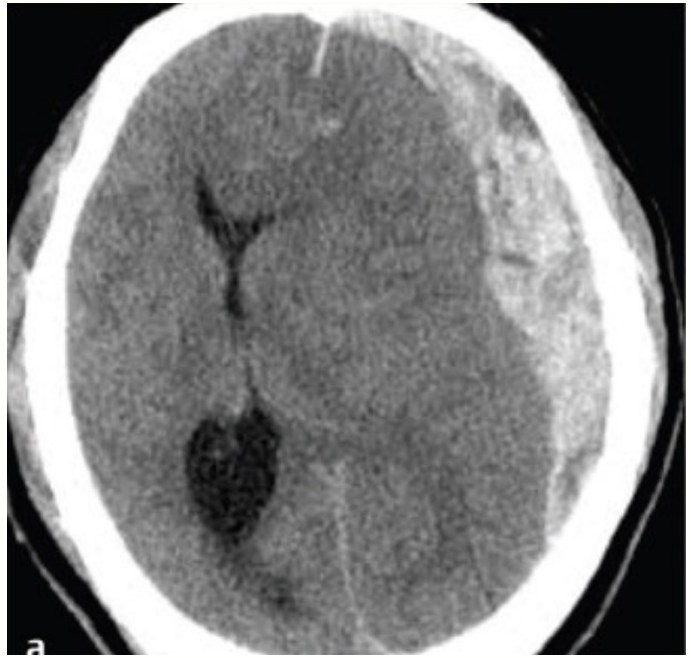
Subdural Hematoma

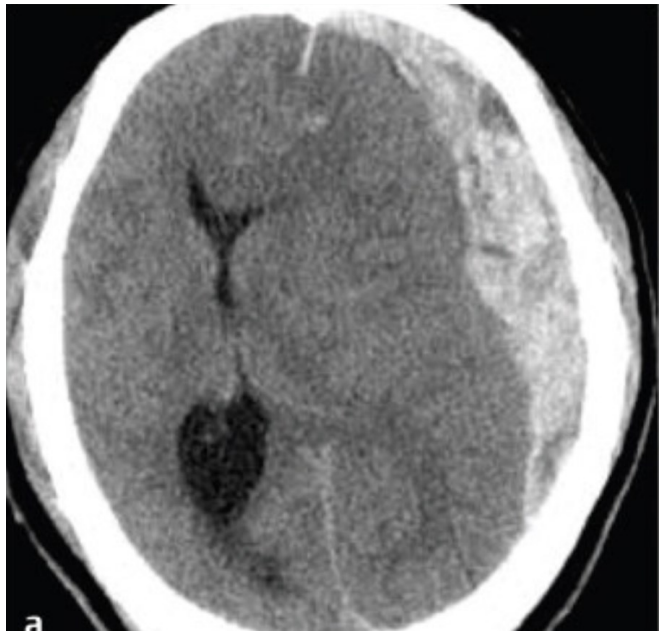
Operative consideration

- <1cm thickness or <5mm midline shift
- SDH >1cm thickness or midline shift >5mm

- Location matters
  - Managed nonoperatively- falcine or interhemispheric, tentorial







Acute (hyperacute)

Subacute

Mixed w/ chronic

- Age of the bleed

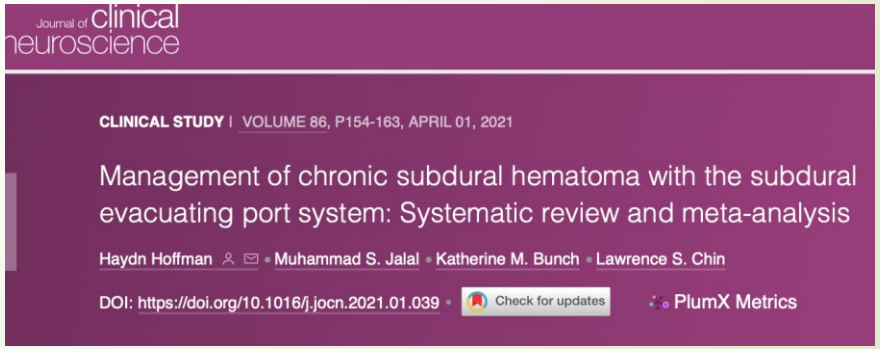
Subacute/ Chronic SDH

- Elderly, Recurrent falls, blood thinners, focal deficits

Consider mixed density, chronic SDH

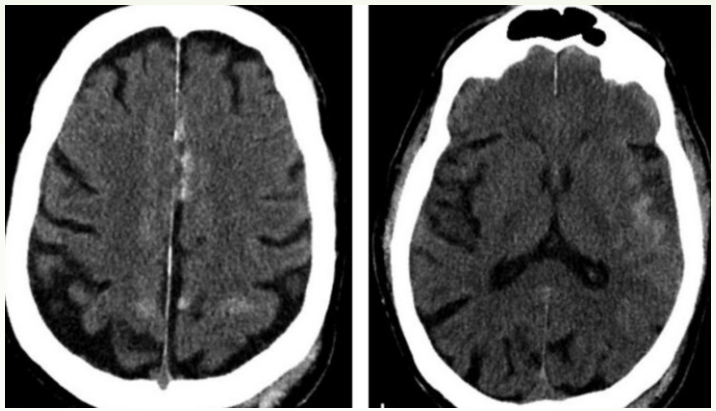
Surgical options

- Craniotomy or craniectomy
- Subdural drain placement
- Subdural evacuation port system placement (SEPS)
- Recurrence up to 30%
- Middle meningeal artery embolization



Subarachnoid Hemorrhage

- 10 per 100,000 person years
- Smoking
- First degree relative
- Hypertension



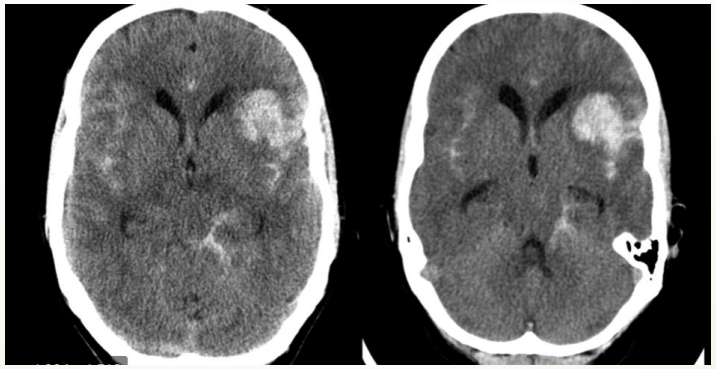
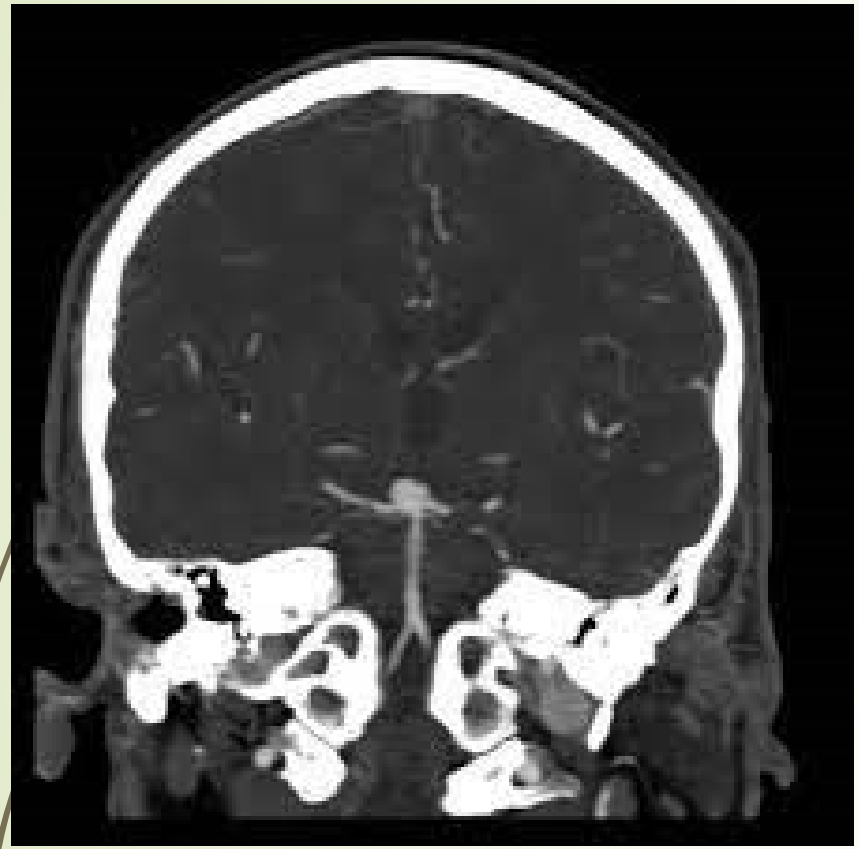
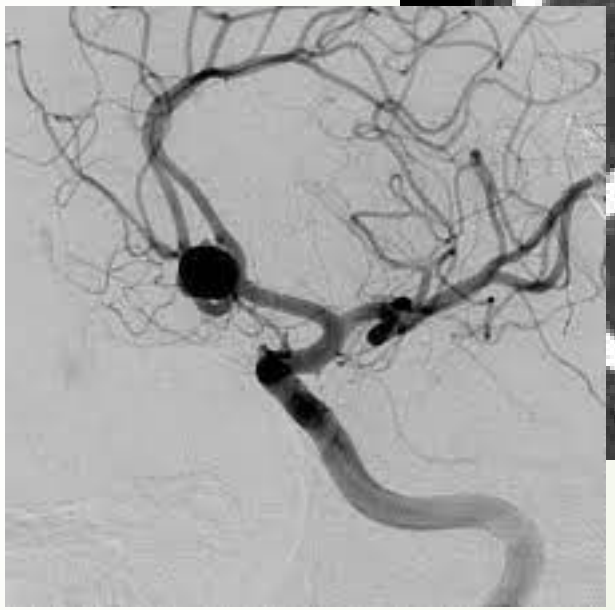


Table 1. Description of Fisher Grading Scale, Fisher et al., 1980 (5)

Grade	Descriptions
Fisher I	No blood detected
Fisher II	Diffuse deposition or thin layer with all vertical layers of blood (interhemispheric fissure, insular cistern, ambient cistern) < 1 mm thick
Fisher III	Localized clots and/or vertical layers of blood ≥ 1 mm in thickness
Fisher IV	Diffuse or no subarachnoid blood, but with intracerebral or intraventricular clots

Cerebral aneurysm

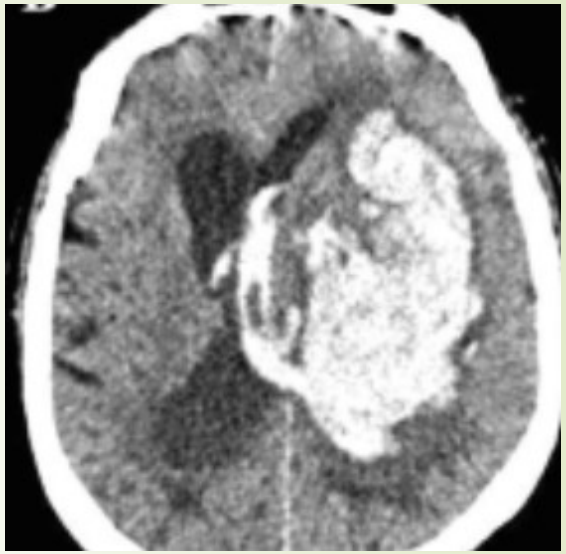




- Rate of rerupture 4% in first 24 hours -> mortality up to 70%
- MAP 70-90
- Hunt Hess 3 or more, ventriculostomy
- Avoid ICP >20 or excess loss of CSF

Intracerebral hemorrhage

- **Location**
  - **MC Basal Ganglia**
  - **Lobar**
  - **Thalamus**
  - **Cerebellum**
  - **Pons**
- **Strong evidence is limited but considerations include**
  - **Salvageable exam (GCS ≥6)**
  - **Intracranial Hypertension-refractory ICP**
  - **Mass effect with basal cisternal effacement**
  - **Volume >50cm3**
- **Timing? 4 to 96 hours?**
  - **<21h? < 8h?**
- **ICH SCORE**
  - **40% 30- day mortality**
- **20% mRS <2**

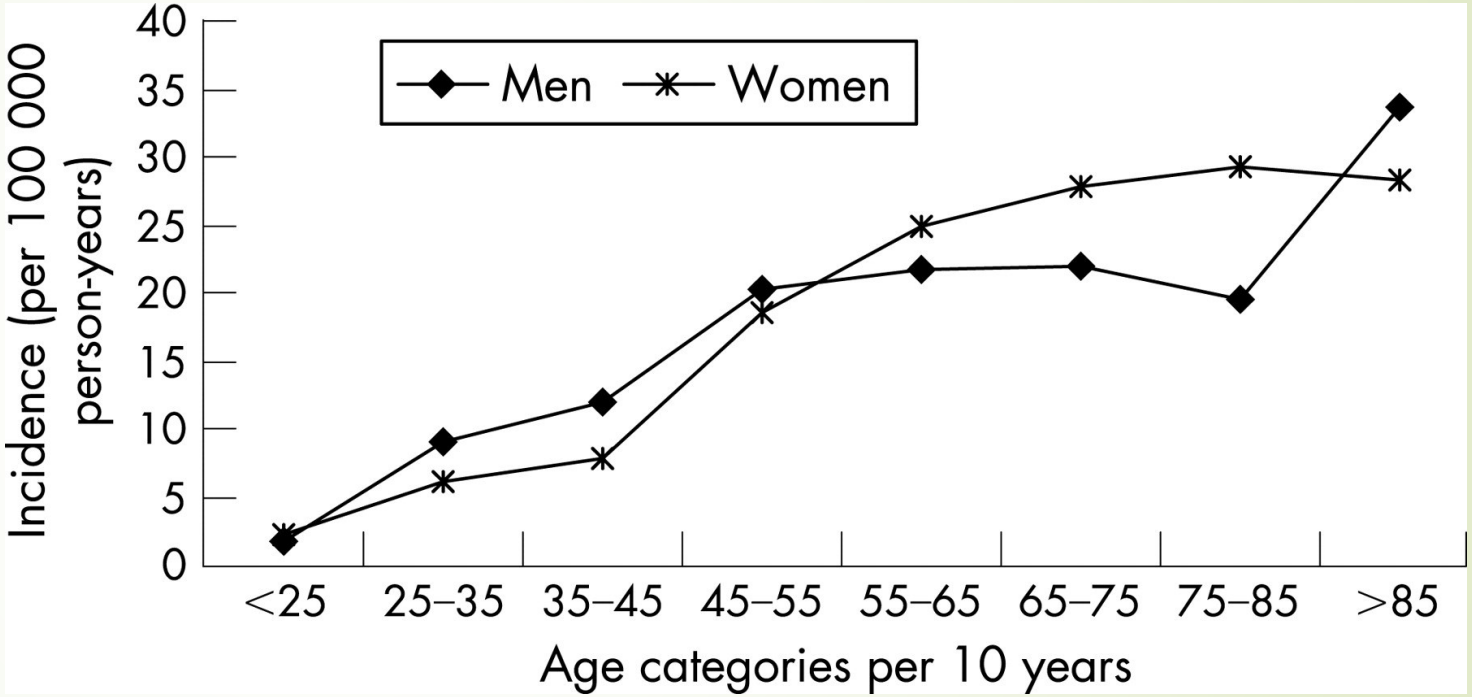


Evidence for surgical evacuation of ICH

- STICH
- MISTIE II
- MISTIE III
- SWITCH

Brain bleeds and risk factors

- Age
- Geography (Japan/Finland)
- Smoking, HTN, HLD, CAD
- Trauma
- Blood Thinners
- Hematological/Oncological disorder
- Underlying Cerebrovascular and Neoplastic Pathologies
- **Atmospheric Pressure changes**
- Drug abuse
- Genetics Apo E4
- **Prior stroke: 43% of strokes develop hemorrhagic transformation**

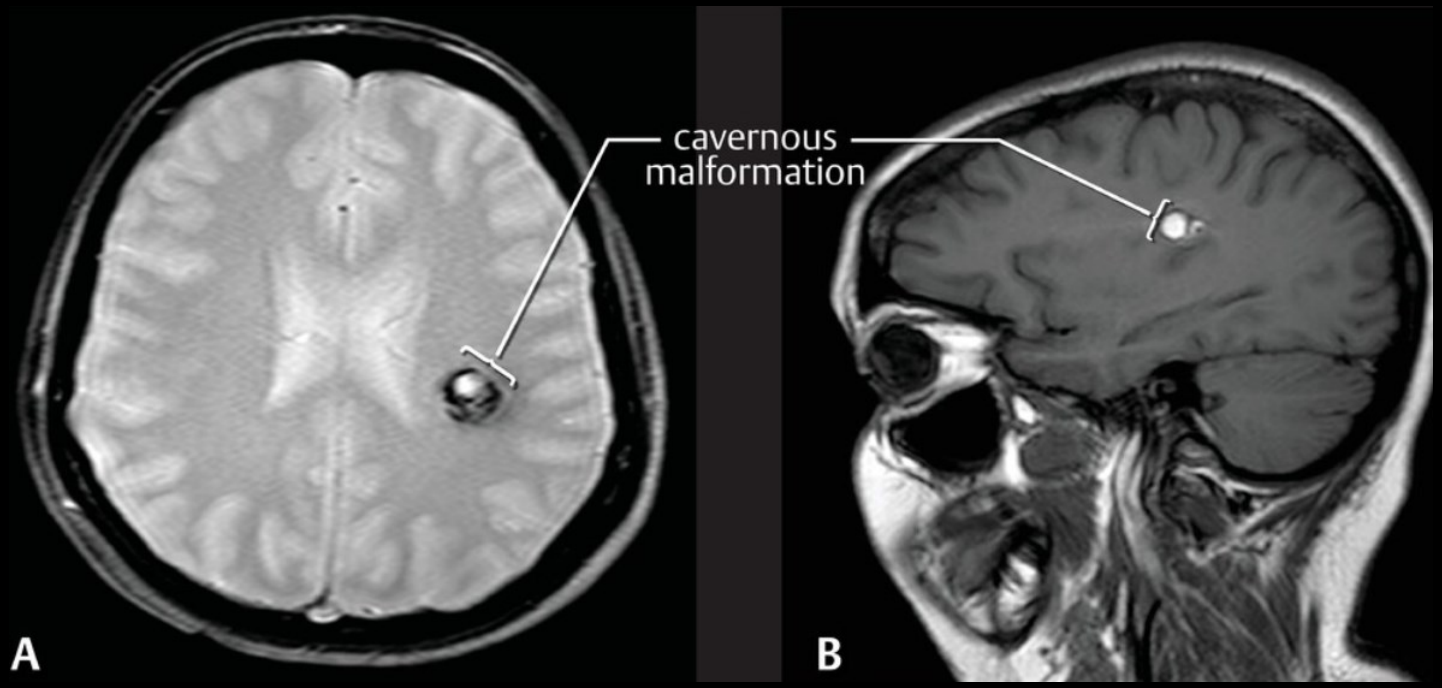


Arteriovenous malformation

- Dilated arteries and veins with no intervening capillary bed between artery and vein

- Annual rupture 2-4%
- Lifetime Risk (%) 105 - Age
- If bleed, rate of rupture up to 1/4% in 1st year but decreases

Spetzler-Martin AVM Grading Scale	Points
Size	
0-3 cm	1
3.1-6.0 cm	2
> 6 cm	3
Location	
Noneloquent	0
Eloquent *	1
Deep venous drainage	
Not Present	0
Present	1
AVM Total Score	1-5



Cavernous malformation

Dural arteriovenous fistula

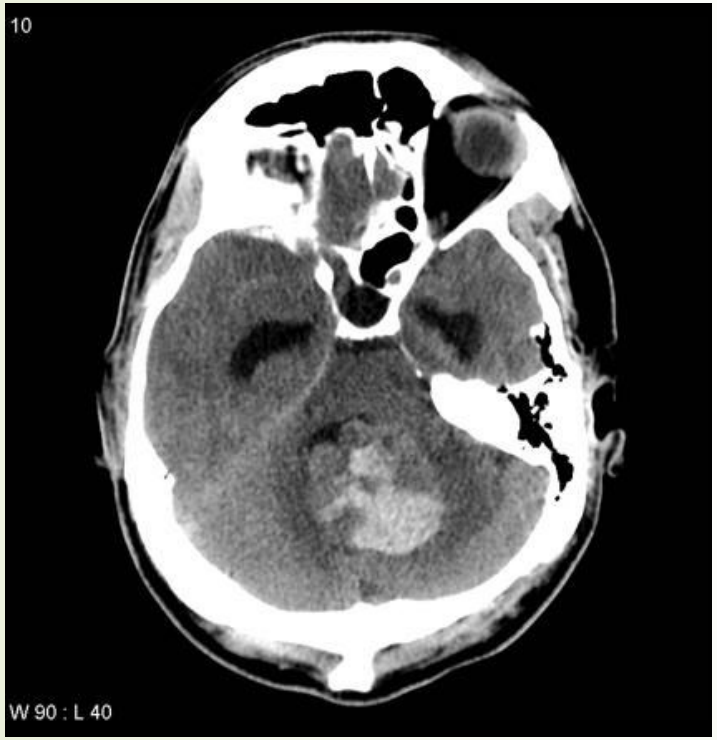
- Arteriovenous shunt within the dural leaflets
- For high-grade dAVF, 8% hemorrhage risk

TABLE 1: Angiographic classification systems for DAVFs

Borden-Shucart Type	Cognard Type	Site of Venous Drainage	Flow Characteristics*
CVD absent			
I	I	dural sinus	antegrade sinus flow
I	IIa	dural sinus	retrograde sinus flow
CVD present			
II	IIb	dural sinus	antegrade sinus flow, CVD
II	IIa + b	dural sinus	retrograde sinus flow, CVD
III	III	CVD	nonectatic cortical vein
III	IV	CVD	ectatic cortical vein
III	V	CVD	spinal perimedullary vein

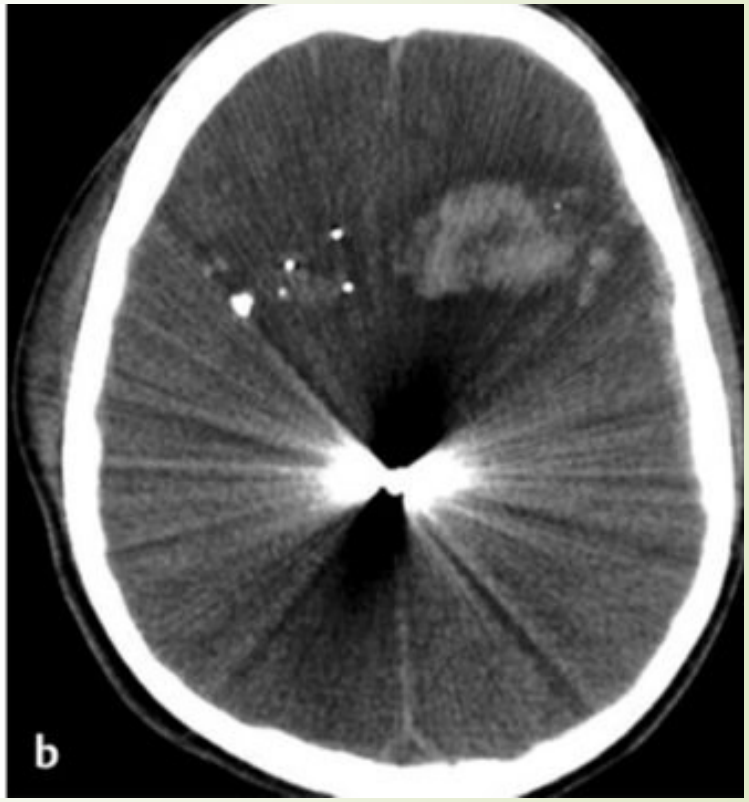
* Applicable only to the Cognard scale.

Primary and Secondary brain tumors

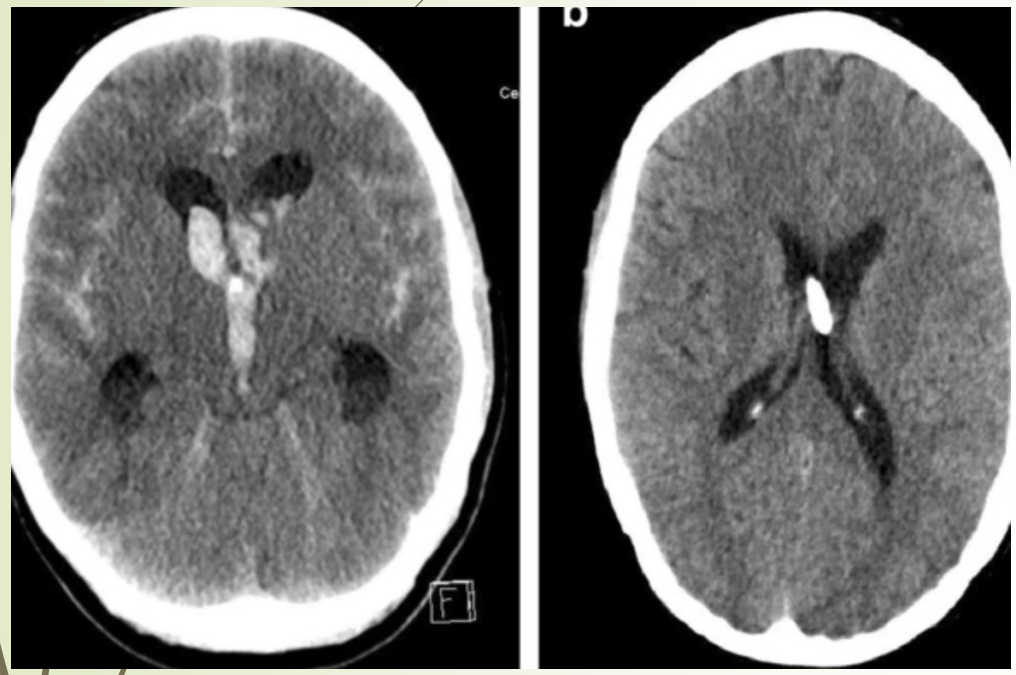


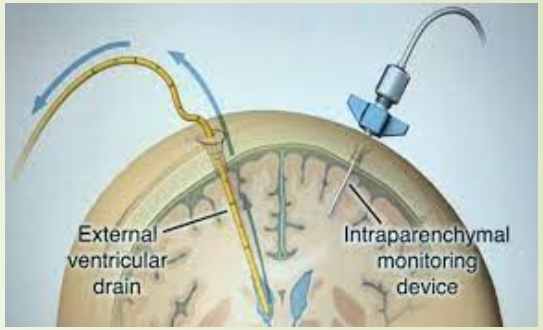
- Primary glioma up to 30% are hemorrhagic
- Melanoma up to 50% are hemorrhagic

Traumatic IPH and Traumatic Contusion

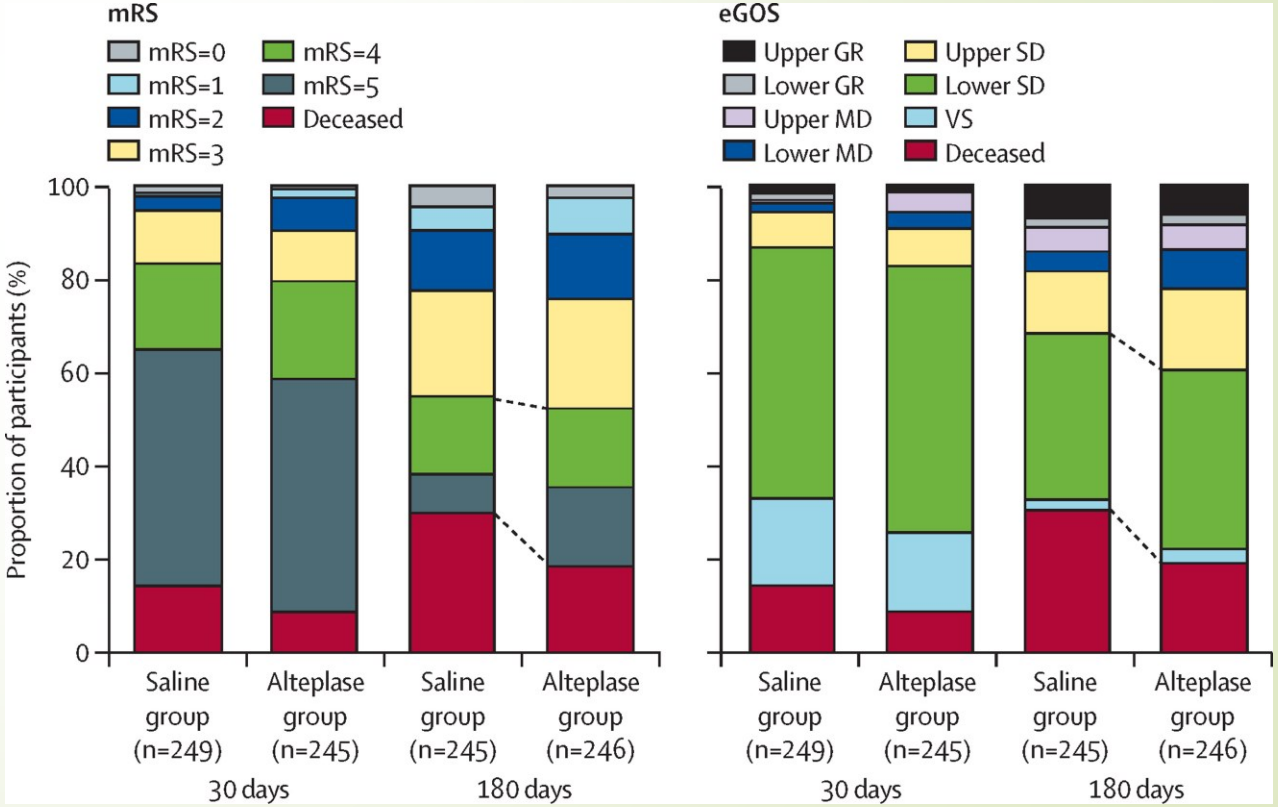


Intraventricular hemorrhage

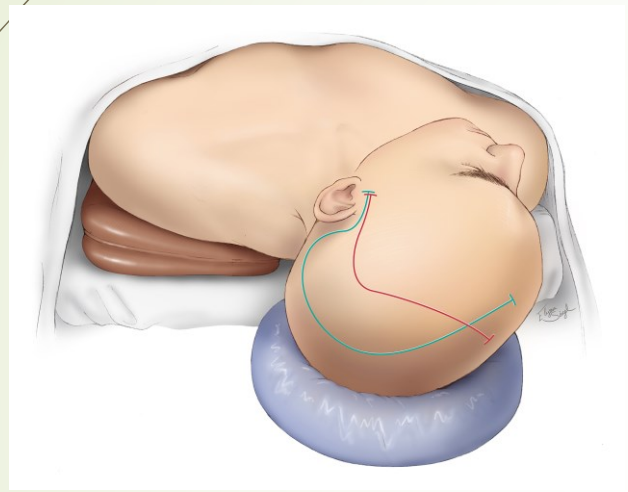


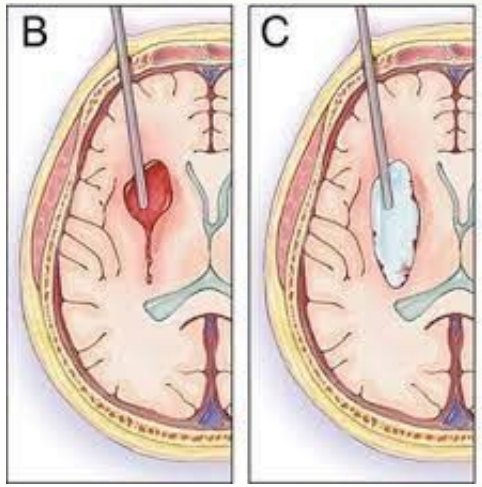


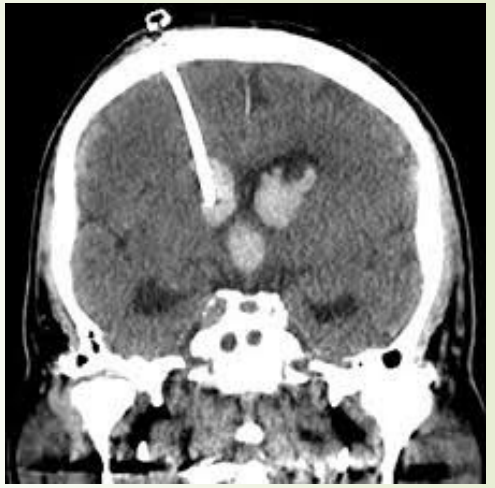
CLEAR III trial

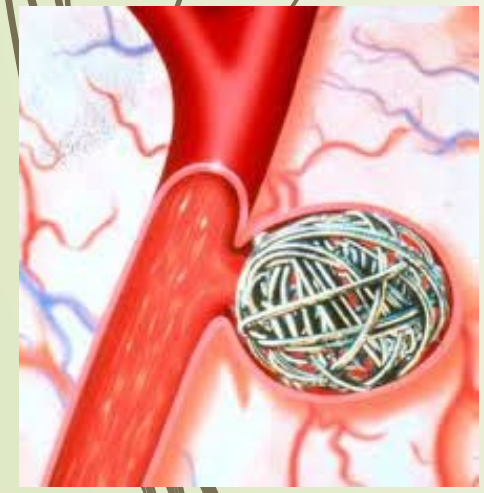


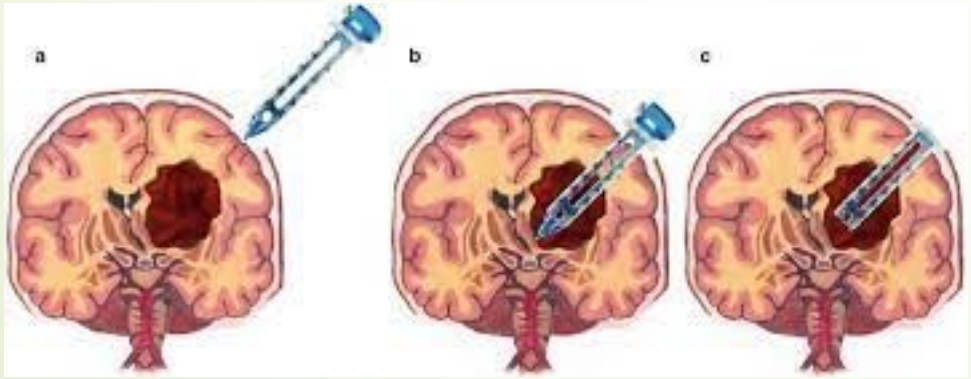
Surgeons Armamentarium











Guidelines

Stroke

AHA/ASA GUIDELINE

2022 Guideline for the Management of Patients With Spontaneous Intracerebral Hemorrhage: A Guideline From the American Heart Association/American Stroke Association

Reviewed for evidence-based integrity and endorsed by the American Association of Neurological Surgeons and Congress of Neurological Surgeons.

Endorsed by the Society of Vascular and Interventional Neurology

The American Academy of Neurology affirms the value of this statement as an educational tool for neurologists.

Endorsed by the Neurocritical Care Society

Steven M. Greenberg, MD, PhD, FAHA, Chair; Wendy C. Ziai, MD, MPH, FAHA, Vice Chair; Charlotte Cordonnier, MD, PhD; Dar Dowlatshahi, MD, PhD, FAHA; Brandon Francis, MD, MPH; Joshua N. Goldstein, MD, PhD, FAHA; J. Claude Hemphill III, MD, MAS, FAHA; Ronda Johnson, MBA; Kiffon M. Keigher, MSN, ACNP-BC, RN, SCRN; William J. Mack, MD, MS, FAHA*; J. Mocco, MD, MS, FAHA†; Eileena J. Newton, MD; Ilana M. Ruff, MD‡; Lauren H. Sansing, MD, MS, FAHA; Sam Schulman, MD, PhD; Magdy H. Selim, MD, PhD, FAHA; Kevin N. Sheth, MD, FAHA*§; Nikola Sprigg, MD; Katharina S. Sunnerhagen, MD, PhD; on behalf of the American Heart Association/American Stroke Association

Stroke
Volume 43, Issue 6, June 2012; Pages 1711-1737
https://doi.org/10.1161/STR.0b013e3182587839

American Heart Association.

AHA/ASA GUIDELINE

Guidelines for the Management of Aneurysmal Subarachnoid Hemorrhage

A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

E. Sander Connolly, Jr, MD, FAHA, Chair, Alejandro A. Rabinstein, MD, Vice Chair, J. Ricardo Carhuapoma, MD, FAHA, Colin P. Derdeyn, MD, FAHA, Jacques Dion, MD, FRCPC, Randall T. Higashida, MD, FAHA, Brian L. Hoh, MD, FAHA, Catherine J. Kirkness, PhD, RN, Andrew M. Naidech, MD, MSPH, Christopher S. Ogilvy, MD, Aman B. Patel, MD, B. Gregory Thompson, MD, and Paul Vespa, MD, FAAN

Table. Guideline Recommendations on Seizures and Antiseizure Medications in sICH[53,54] (Table view)

Organization	Recommendation	Evidence	Change From Previous
American Heart Association(2015)	Clinical seizures should be treated with antiseizure drugs.	Class I; level A	Unchanged
	Patients with a change in mental status who are found to have electrographic seizures on EEG should be treated with antiseizure drugs.	Class I; level C	Unchanged
	Continuous EEG monitoring is probably indicated in ICH patients with depressed mental status that is out of proportion to the degree of brain injury.	Class IIa; level C	Revised
	Prophylactic antiseizure medication is not recommended.	Class III; level B	Unchanged
European Stroke Organization(2014)	There is insufficient evidence from RCTs to make strong recommendations on whether preventive antiseizure treatment should be used after ICH for the prevention of seizures or improvement of outcome in the long term.	Quality low; strength weak	NA
	There is insufficient evidence from RCTs to make strong recommendations about how, when, and for whom antiseizure medications should be given to reduce the risk of epilepsy after ICH	Quality low; strength weak	NA

Takeaways

- ABCDs
- **Neurological exam: i.e: Glasgow Coma Scale or NIHSS; focal exam or seizure?**
- Labs (CBC and INR/PTT)
- Hx of Antiplatelet/Anticoagulant agents
- CT head without contrast
  - CT angiography head and neck
- Trauma assessment?
- Neurological ICU
- **Neurological Surgery**
  - Surgical Intervention or not
- Are there management guidelines?
- **Patient and Family wishes**

Thank you!

- Thank you to Raisa, Josh, Michelle and Pat