UPMC LIFE CHANGING MEDICINE

Modern Management of Major Hemorrhage

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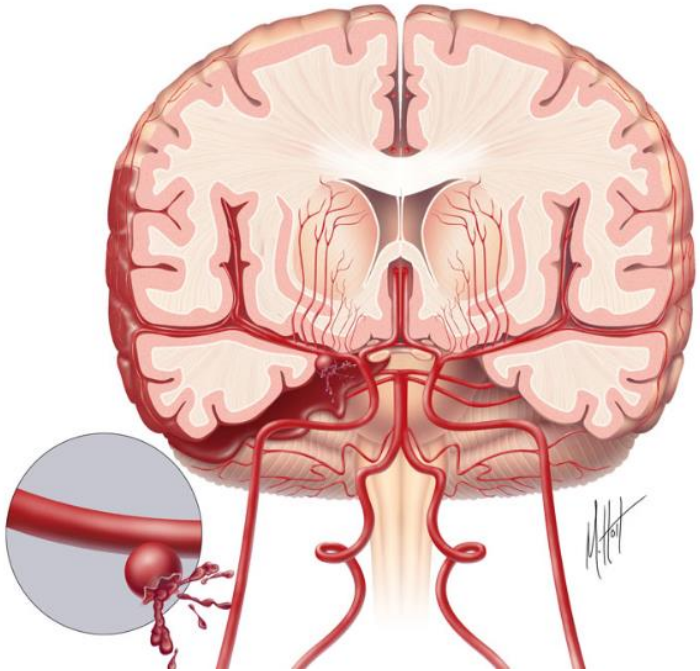
Outline

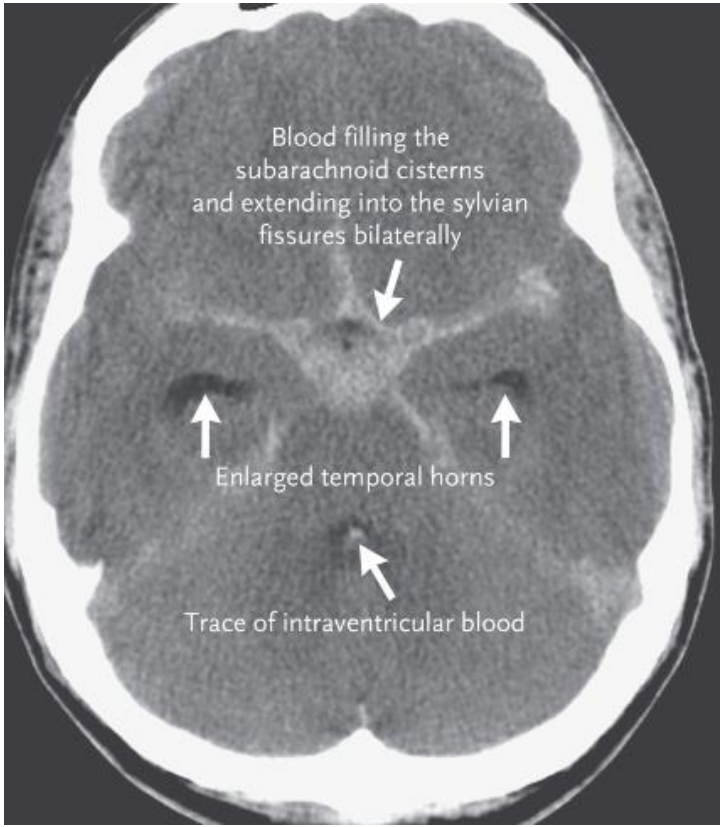
- SAH statistics
- Presentation and Triage
- Aneurysm Treatment
- Complications
- Outcomes

Bleeding into the space surrounding the brain

- Characterized by
  1. Sudden onset WHOL (80%)
  2. Nuchal Rigidity
  3. Nausea and vomiting
  4. Seizures
  5. Loss of consciousness
- Risk factors
  1. Hypertension
  2. Smoking
  3. Drug use
  4. Family history



- 85 % caused by ruptured intracranial aneurysm



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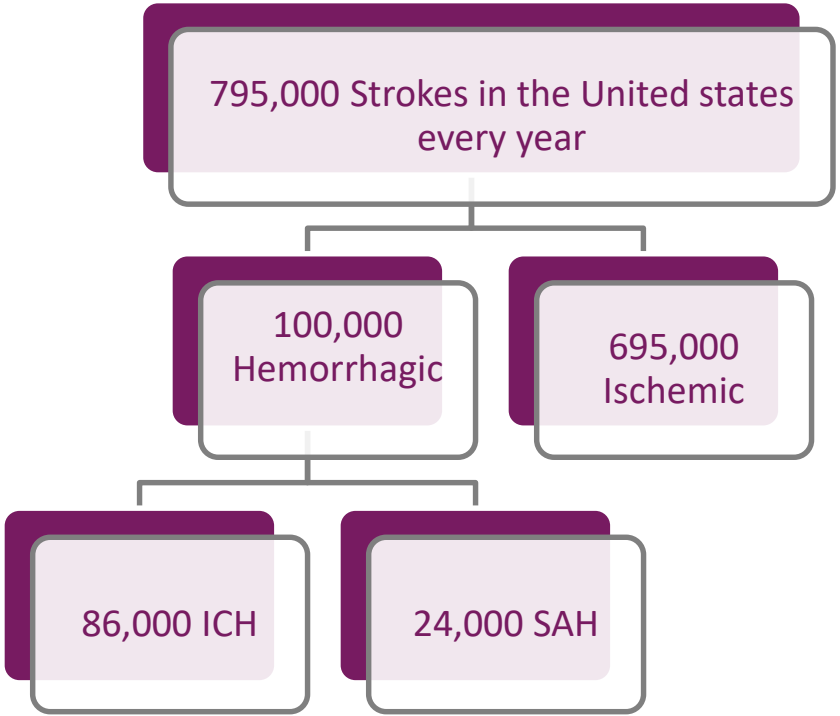
Subarachnoid Hemorrhage Incidence



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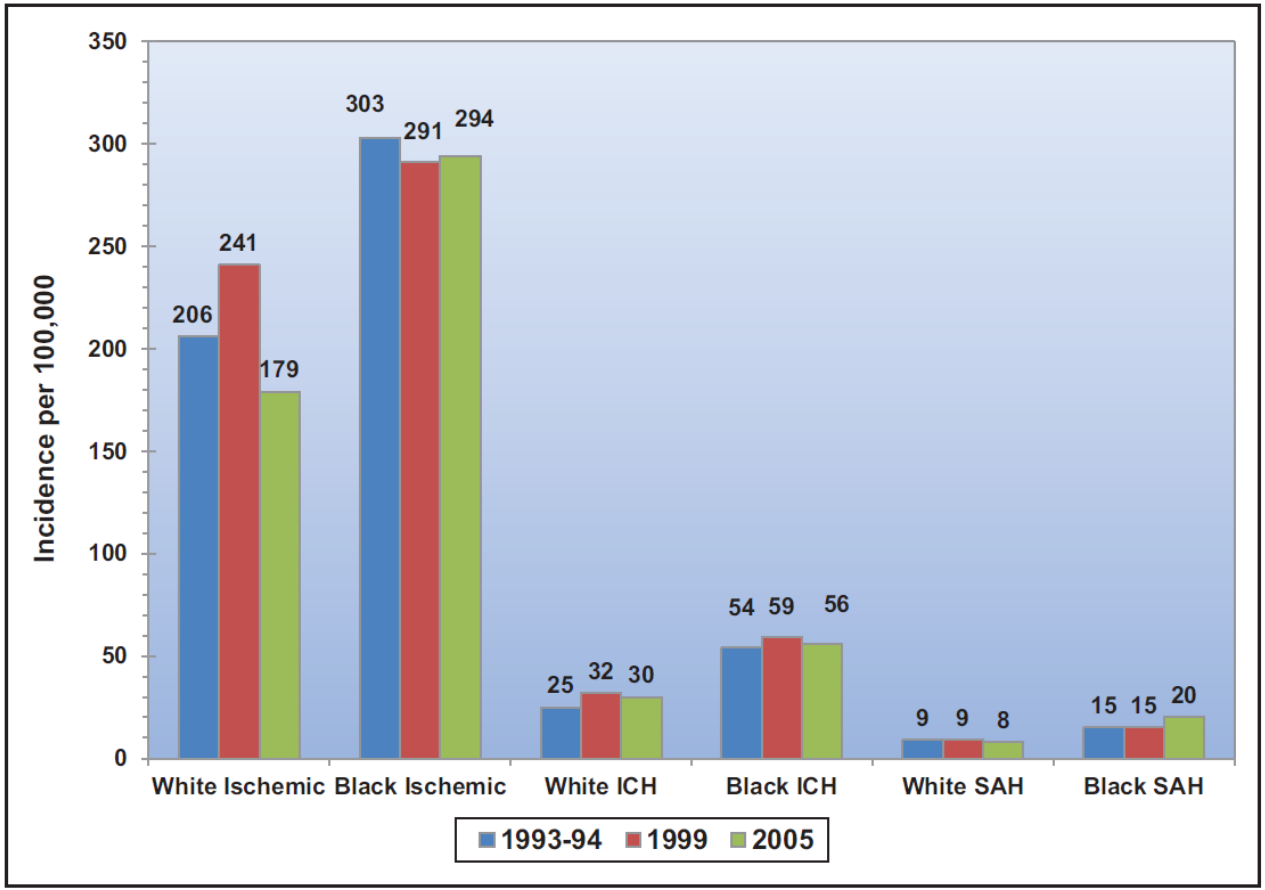
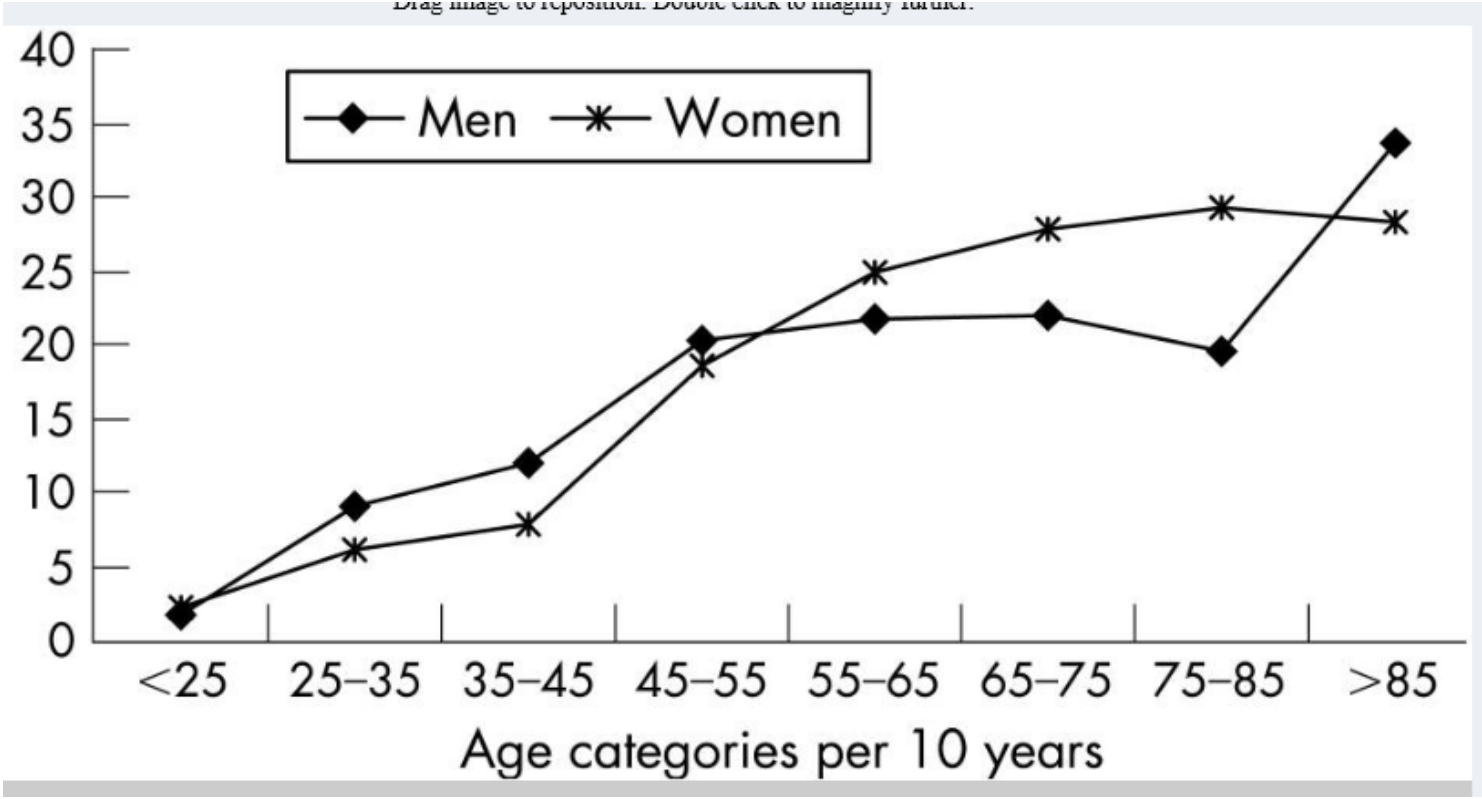


Circulation. 2018;137:e67–e492. DOI: 10.1161/CIR.0000000000000558



J Neurol Neurosurg Psychiatry. 2007 Dec; 78(12): 1365–1372.

Mortality

Pre-hospital mortality = 15%

In-Hospital mortality = 18%

6 month mortality = 52%

Accounts for 27% of all stroke related life years lost

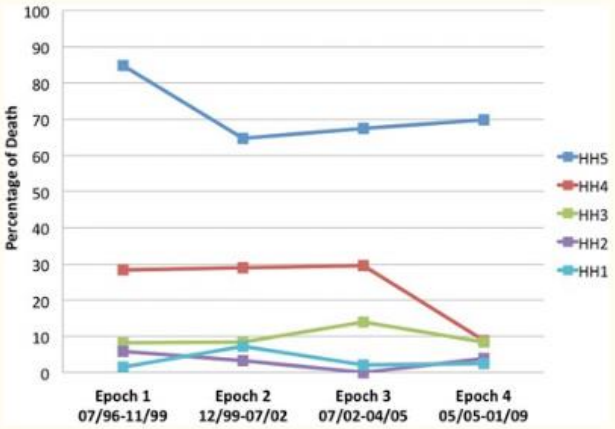


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Fig. 4

Hospital mortality according to admission Hunt-Hess grade over the 12.5-year study period. Each time epoch represents 300 consecutive admissions. A dramatic fall in mortality was observed among grade 5 patients between epochs 1 and 2; a similar reduction occurred among grade 4 patients between epochs 3 and 4. *HH* Hunt-Hess

Lantigua H, et al. Crit Care. 2015 Aug 31;19:309.

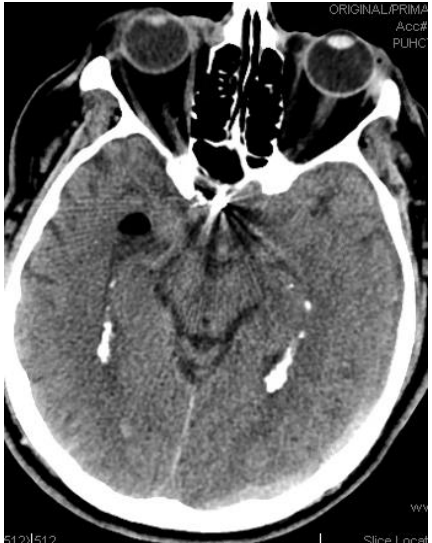
Table 4

Relationship of medical and neurological complications to in-hospital mortality

			Univariate/Unadjusted			Multivariate/Adjusted[a]		
	Survivors	Non-survivors	OR	95 % CI	*P* value	OR	95 % CI	*P* value
Fever >101.5 F	480 (49)	137 (63)	1.9	1.4–2.6	0.000	0.8	0.5–1.3	0.35
Hyperglycemia, >200 mg/dl	408 (42)	143 (66)	2.9	2.1–4.0	0.000	1.1	0.7–1.8	0.76
Hydrocephalus requiring EVD or VPS	289 (29)	142 (66)	4.7	3.5–6.5	0.417	1.4	0.9–2.2	0.15
Anemia requiring transfusion	319 (32)	75 (35)	1.1	0.8–1.6	0.000	0.7	0.45–1.0	0.10
Global cerebral edema	205 (21)	107 (50)	3.7	2.8–5.2	0.000	1.8	1.1–2.9	0.02
New infarct on CT scan	233 (24)	78 (36)	2.0	1.5–2.8	0.000	0.7	0.4–1.1	0.09
ICP crisis or herniation[a]	153 (16)	106 (49)	5.7	4.0–7.9	0.000	2.5	1.4–3.7	0.00
Hypotension, <90 mm Hg[b]	160 (16)	122 (57)	6.7	4.9–9.2	0.000	3.4	2.2–5.3	0.00
Pneumonia	191 (19)	67 (31)	1.9	1.4–2.7	0.000	0.6	0.4–1.0	0.06
Hypernatremia, >150 mEq/l	151 (15)	99 (46)	5.1	3.6–7.1	0.000	2.1	1.3–3.4	0.00
Urinary tract infection	226 (23)	13 (6)	0.2	0.1–0.4	0.881	0.1	0.0–0.2	0.00
Clinical deterioration from vasospasm	170 (17)	36 (17)	0.9	0.7–1.4	0.000	0.9	0.6–1.6	0.81
Pulmonary edema	137 (14)	68 (32)	2.9	2.0–4.1	0.000	1.3	0.8–2.0	0.33
Herniation	62 (6)	106 (50)	15.3	10.5–22.1	0.052	8.3	4.9–14.3	0.00
Hyponatremia, <130 mEq/l	140 (14)	20 (9)	0.6	0.4–1.0	0.010	0.5	0.3–0.96	0.04
Sepsis/Bacteremia	91 (9)	32 (15)	1.8	1.1–2.7	0.000	1.4	0.79–2.4	0.26
Arrhythmia	71 (7)	49 (23)	3.7	2.5–5.6	0.000	1.6	0.9–2.8	0.09
Aneurysm rebleeding	54 (6)	64 (30)	6.9	4.6–10.4	0.000	3.5	1.9–5.9	0.00
Congestive heart failure	62 (6)	39 (18)	3.3	2.1–5.1	0.001	2.2	1.3–3.8	0.00
Seizures	55 (6)	25 (12)	2.3	1.4–3.8	0.068	1.6	0.8–3.0	0.20
Delayed cerebral ischemia								
Symptomatic vasospasm without infarct	104 (11)	14 (7)	0.6	0.3–1.0	0.095	0.5	0.3–1.0	0.06
Symptomatic vasospasm with infarct	64 (7)	21 (10)	1.5	0.9–2.6	0.004	1.9	1.0–3.7	0.07
No symptomatic vasospasm with infarct	23 (2)	13 (6)	2.7	1.3–5.4	0.000	2.2	0.8–5.8	0.13
Non-neurogenic myocardial ischemia	46 (5)	43 (20)	5.1	3.3–8.1	0.000	2.8	1.6–5.1	0.00
Hepatic injury, AST or ALT >200 mg/dl	24 (2)	22 (10)	4.6	2.5–8.4	0.000	2.5	1.2–5.3	0.01
GI bleeding requiring transfusion	19 (2)	14 (7)	3.5	1.7–7.1	0.000	1.7	0.7–4.3	0.27

Lantigua H, et al. Crit Care. 2015 Aug 31;19:309.








What is the difference?

Triage

- Non contrast CT
- Lumbar Puncture
- MRI
- CTA
- DSA

Transfer?

- High volume centers:
  - 1.6 OR for treatment of aneurysm
  - Lower mortality (39% vs 27%)
  - Better rates of good outcome
- $10,548 = 1.6 QALY gain

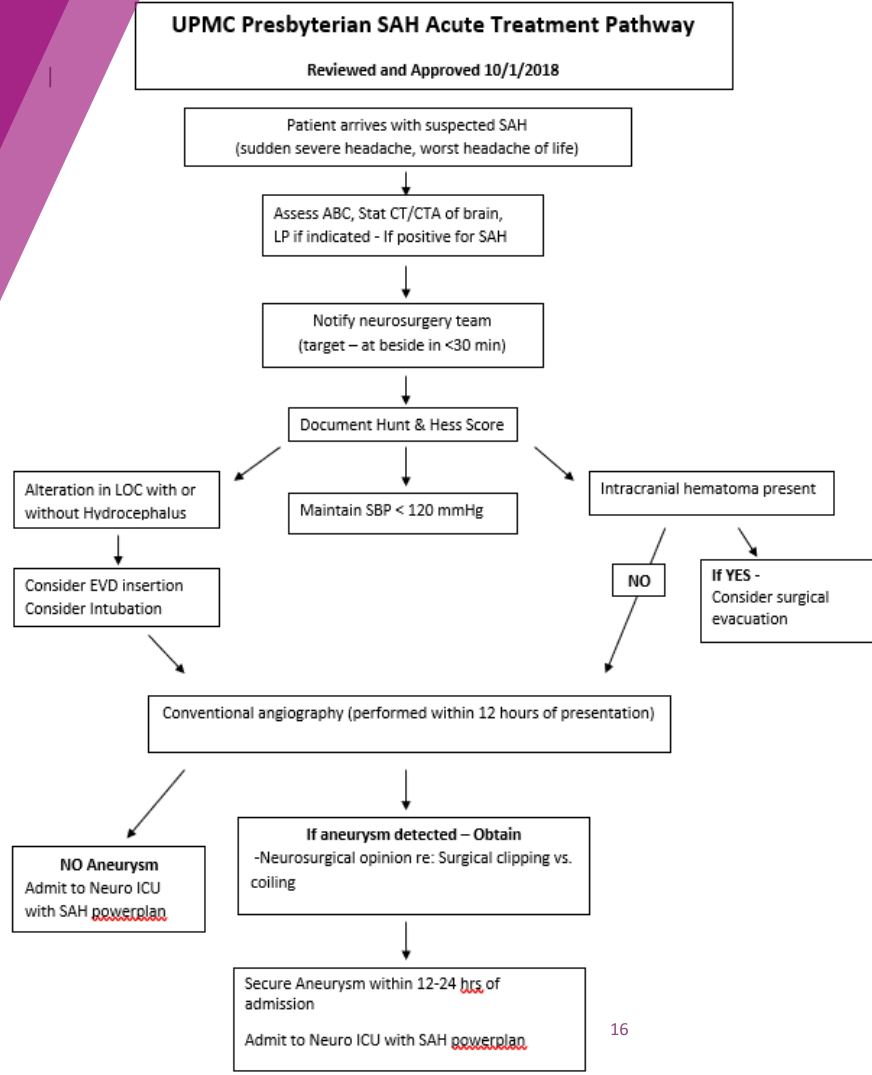
Connolly ES. Et al. Stroke. 2012; 43 1711-1737

Transfer

- AHA REC “Low-volume hospitals (eg <10 cases per year) should consider transfer of patients with aSAH to high-volume centers (eg >35 cases per year) with experienced cerebrovascular surgeons, endovascular specialists, and multidisciplinary neuro-intensive care services” Class I - B

Early Management

- Blood Pressure Control
  - AHA CPG = <160
  - UPMC
    - H/H grades 1/2/3 = <120
    - H/H grades 4/5 = <140
- Neurologic status
  - Assess hourly for decline
- Consider EVD
- Secure Aneurysm
  - Target first 24 hours



Connolly ES. Et al. Stroke. 2012; 43 1711-1737

Severity Classification

Grade	Characteristics	Mortality Rate (%)
0	Unruptured aneurysm without symptoms	0
1	Asymptomatic or minimal headache and slight nuchal rigidity	1
1a	No acute meningeal or brain reaction but with fixed neurologic deficit	1
2	Moderate to severe headache, nuchal rigidity, no neurologic deficit other than cranial nerve palsy	5
3	Drowsy, confused, or mild focal deficit	19
4	Stupor, moderate to severe hemiparesis, possible early decerebrate rigidity, and vegetative disturbances	42
5	Deep coma, decerebrate rigidity, moribund	77

TJC CSTK -3a

WFNS Grade	Glasgow Coma Scale Score	Motor Deficit
I	15	Absent
II	14-13	Absent
III	14-13	Present
IV	12-7	Present or absent
V	6-3	Present or absent

	SAH MORTALITY BY GRADE UPMC Presbyterian				
GRADE	2016	2017	2018	TOTAL	Mortality
1	0/18	0/13	0/11	0/42	0%
2	3/49	0/39	3/35	6/123	4.8%
3	5/29	1/22	2/17	8/68	11.7 %
4	4/9	0/13	4/11	8/33	24.2 %
5	5/21	4/10	9/13	18/44	40.9 %
Not Done	2/14	0/10	6/23	8/47	
TOTAL	19/140	5/107	24/110	48/357	13.4 %

Aneurysm Treatment

- Primary objective after identification of SAH
  - Best way to prevent rebleed
- AHA:
  - “Surgical clipping or endovascular coiling of the ruptured aneurysm should be performed as early as feasible in the majority of patients to reduce the risk of rebleeding” 1-B
  - “Complete Obliteration of the aneurysm is recommended whenever possible” 1 -B

Connolly ES. Et al. Stroke. 2012; 43 1711-1737

International Subarachnoid Aneurysm Trial (ISAT) of neurosurgical clipping versus endovascular coiling in 2143 patients with ruptured intracranial aneurysms: a randomised trial

Findings 190 of 801 (23·7%) patients allocated endovascular treatment were dependent or dead at 1 year compared with 243 of 793 (30·6%) allocated neurosurgical treatment (p=0·0019). The relative and absolute risk reductions in dependency or death after allocation to an endovascular versus neurosurgical treatment were 22·6% (95% CI 8·9–34·2) and 6·9% (2·5–11·3), respectively. The risk of rebleeding from the ruptured aneurysm after 1 year was two per 1276 and zero per 1081 patient-years for patients allocated endovascular and neurosurgical treatment, respectively.

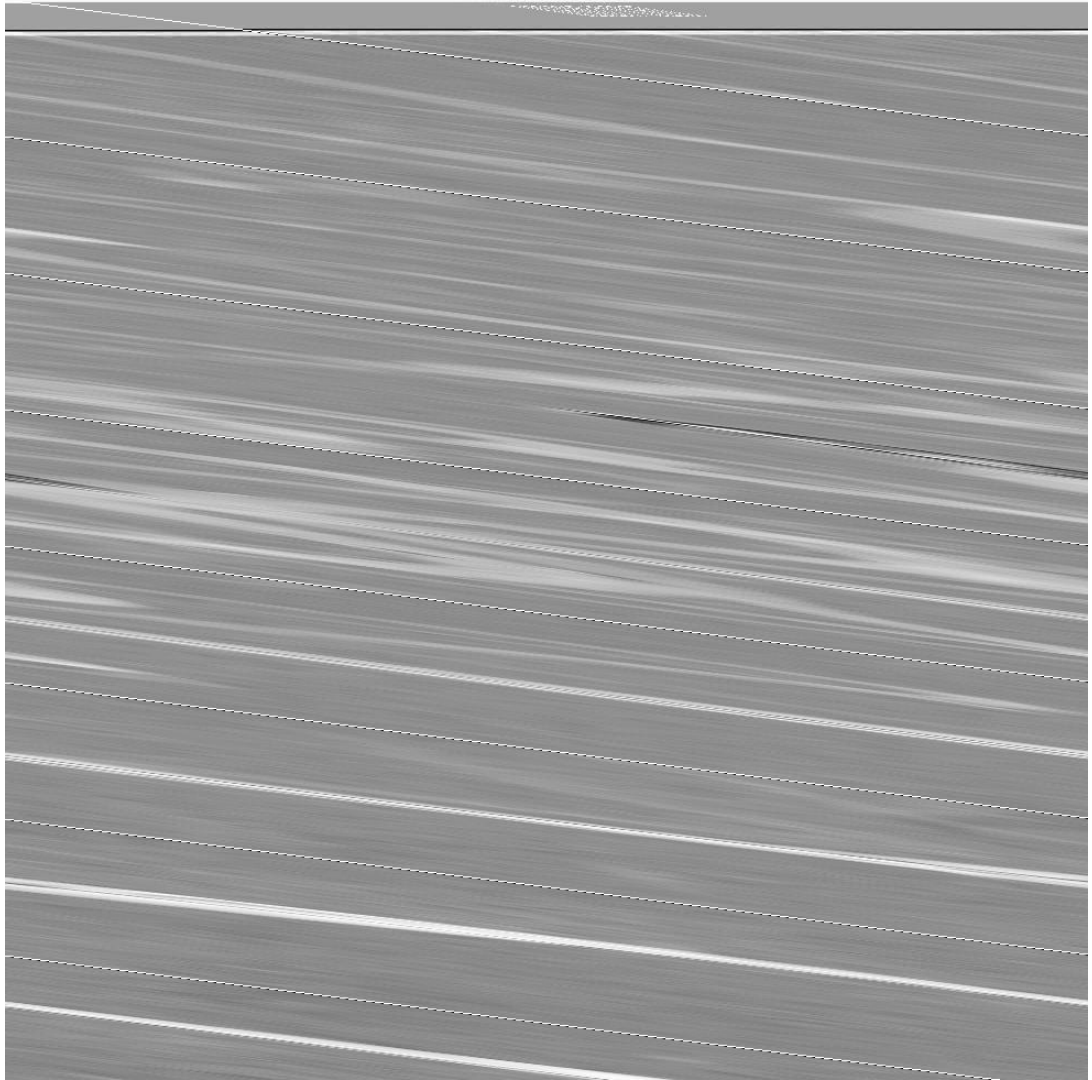
ascertainment of rebleeds and death. The primary outcome was the proportion of patients with a modified Rankin scale score of 3–6 (dependency or death) at 1 year. Trial recruitment was stopped by the steering committee after a planned interim analysis. Analysis was per protocol.

microsurgical techniques and instruments, advances in anaesthetic and intensive-care management, improved diagnostic facilities, and the development of vascular neurosurgery as a subspecialty. Nonetheless, even with these advances, relatively few patients return to a

Clinical Practice

- AHA – “for patients with aneurysm judged to be technically amenable to both endovascular coiling and microsurgical clipping , endovascular coiling should be considered” 1-B
- 80 % coil vs clip rates
- Individualize
- Consider all factors
  - Size, shape, location, age, presence of hematoma

Connolly ES. Et al. Stroke. 2012; 43 1711-1737



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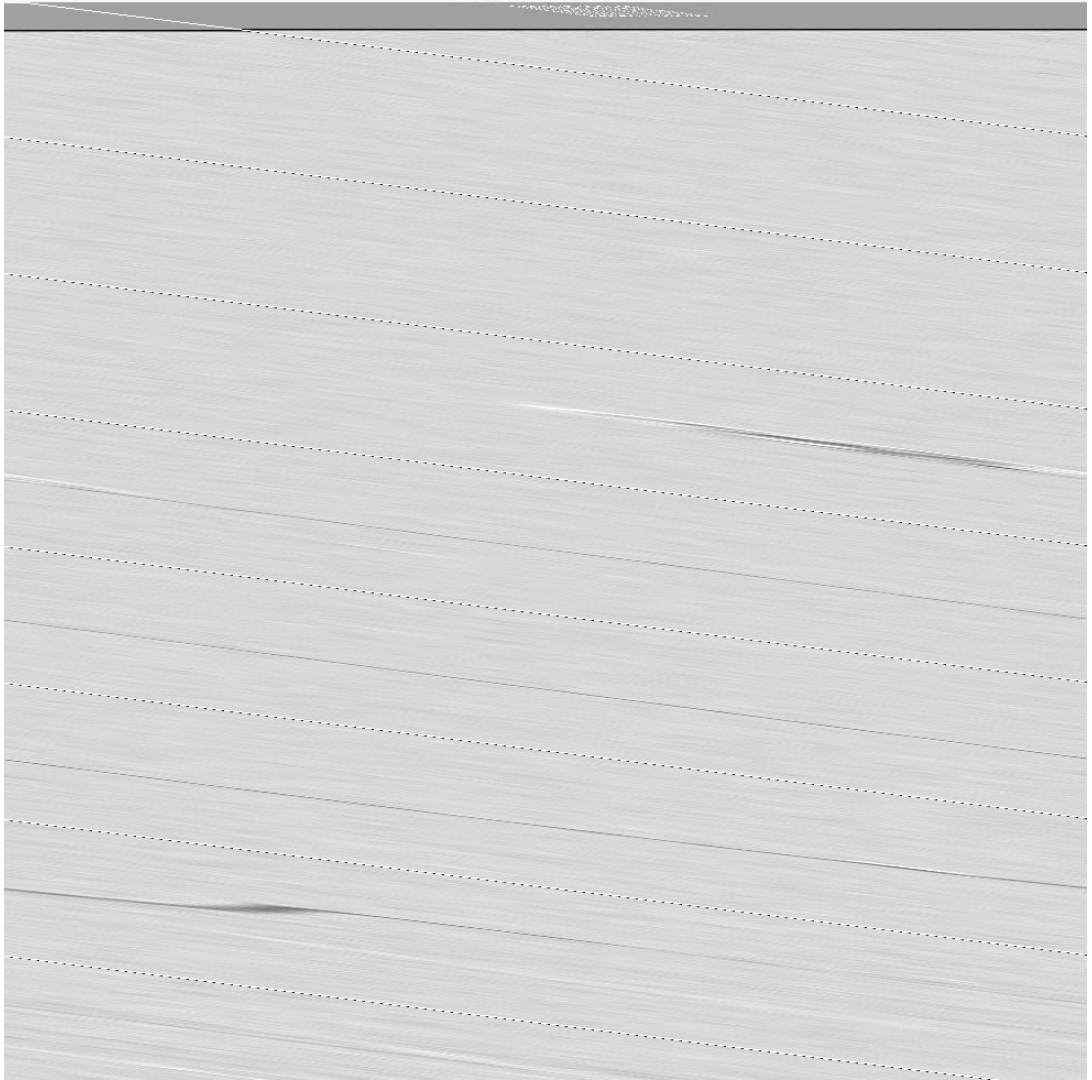

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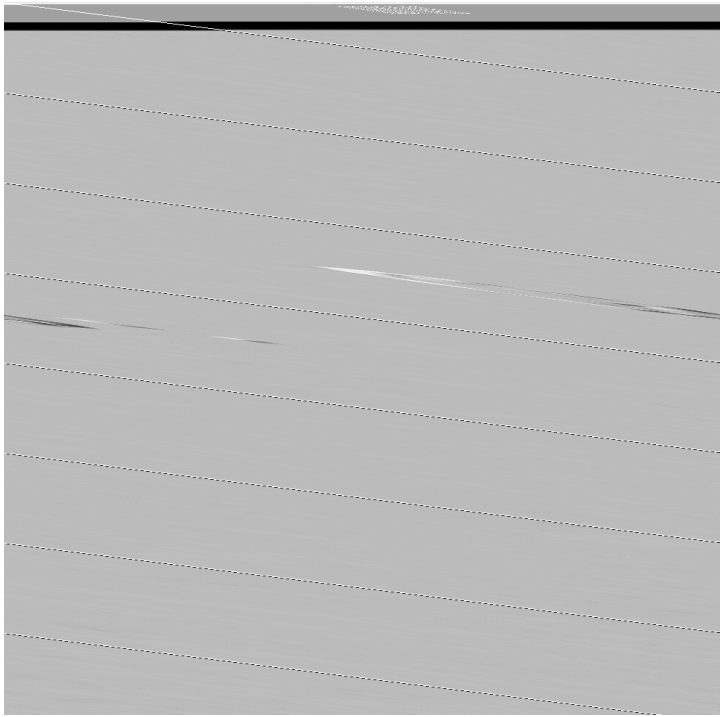
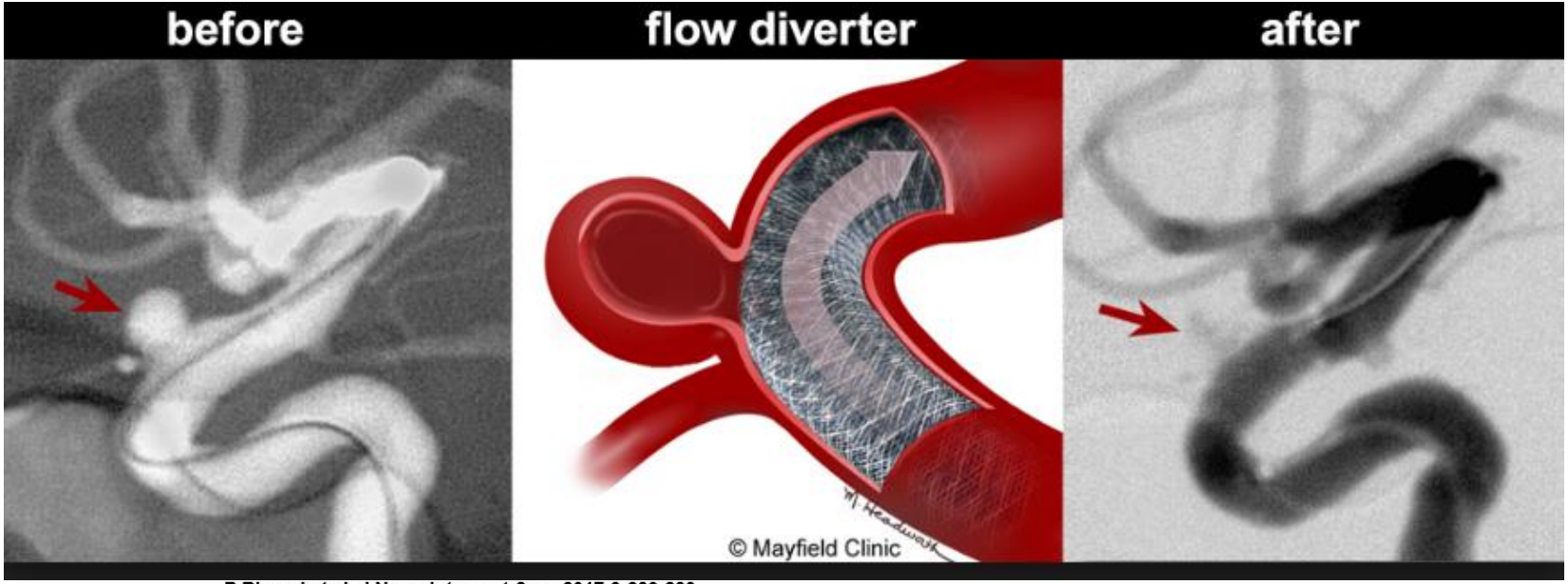


A patient in their early teens was treated with a single p64 flow diverter for an unruptured aneurysm arising from the proximal A1 segment of the right anterior cerebral artery.



P Bhogal et al. J NeuroIntervent Surg 2017;9:283-289

JNIS

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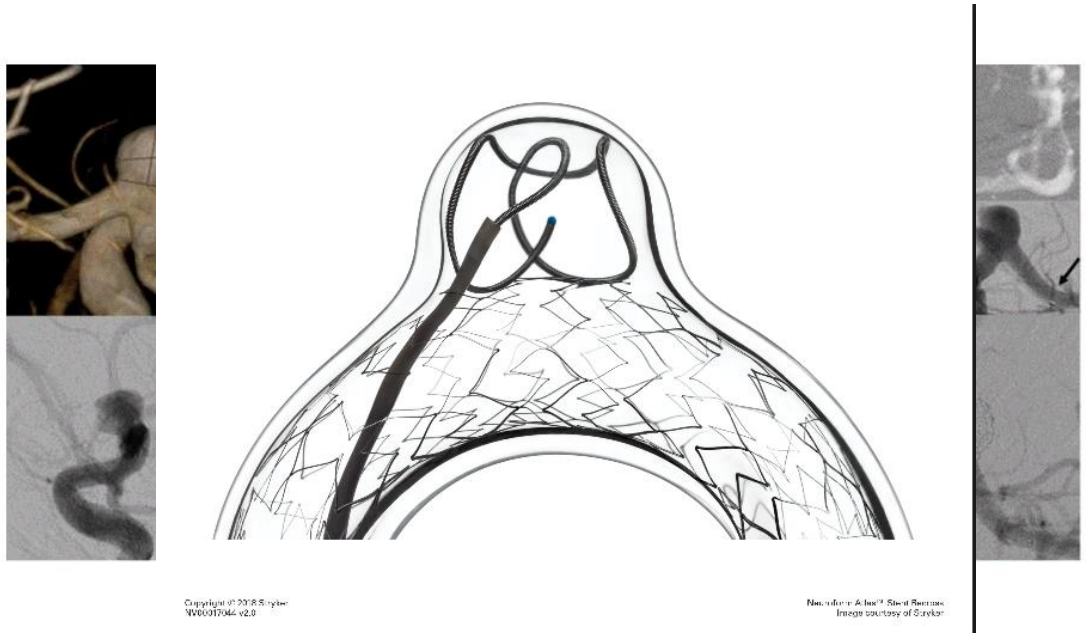
A middle-aged patient with 9 mm internal carotid artery-terminus aneurysm with contralateral access via SL-10 microcatheter, avoiding Y-stent, and demonstrating the trackability of the Neuroform Atlas stent (upper row), with complete occlusion at 12 months follow-up (lower row).



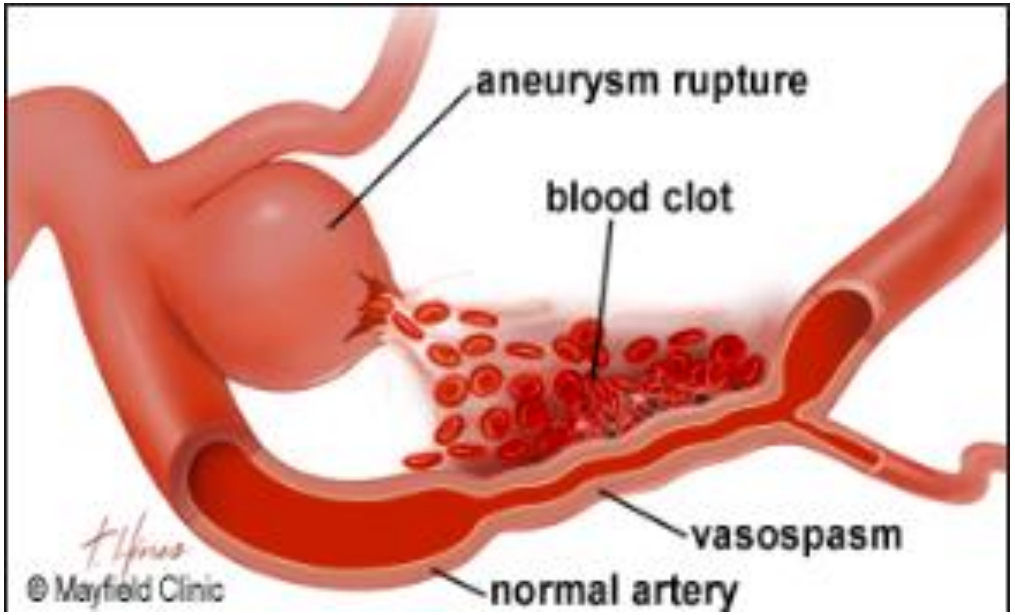
Brian T Jankowitz et al. J NeuroIntervent Surg
doi:10.1136/neurintsurg-2018-014455

Ongoing Care

- Vasospasm
- Hydrocephalus
- Fluid and electrolyte status
- Fever
- VTE
- Seizures

Vasospasm

- DCI vs angiographic vasospasm
- Begins post bleed day 3
- Most common day 7-10
- Out of risk day 21



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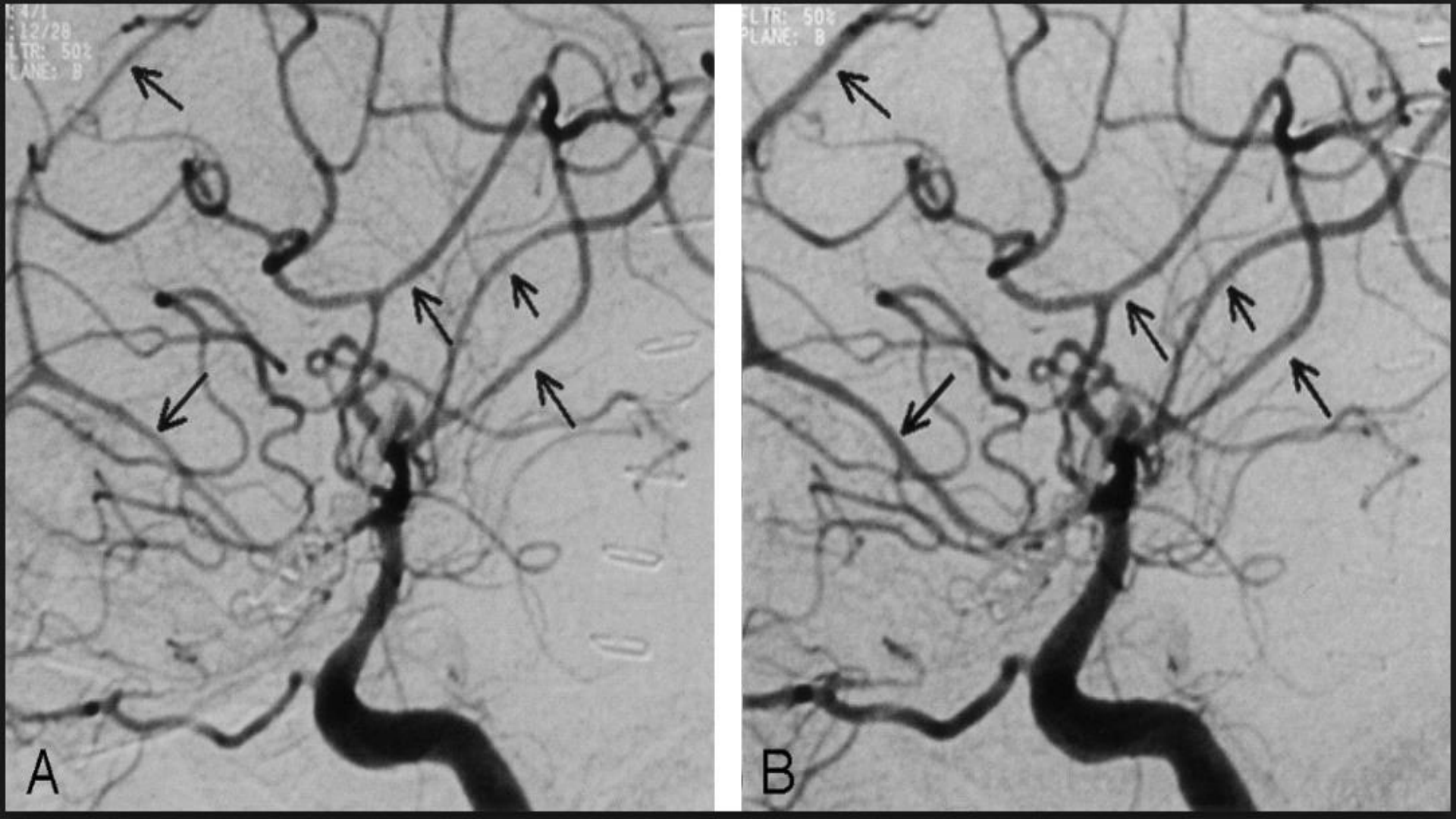

A
B

vasospasm

- Cause
- Prevention – Nimodipine, Euvolemia
- Monitoring – serial exams, TCD, follow-up angiography
- Treatment – hypertension, angioplasty, direct vasodilators

Connolly ES. Et al. Stroke. 2012; 43 1711-1737

Hydrocephalus

- Occurs in up to 80% of aSAH
- Fluid Diversion
  - EVD
  - LD
  - Long-term

Fluid status

- Hyponatremia occurs in 30% of aSAH
- Hyponatremia and Cerebral Salt Wasting
  - Goal of maintaining eunatremia
  - Treatment options
    - Fludrocortisone
    - 3% saline should be considered when other measures to maintain eunatremia have failed
- Strict I/O targeting euvolemia
- Daily weights

Fever

- Most common complication after aSAH
- Target normothermia
- Treat any fever over 37.5
  - Tylenol
  - Surface cooling
  - Intravascular cooling

Connolly ES. Et al. Stroke. 2012; 43 1711-1737

VTE

- Prophylaxis
  - SCDs for all patients
  - Pharmacologic prophylaxis 24 hours post-operative / post-procedure
- Diagnosis
  - LE Dopplers on post-bleed day #5 and q5 days thereafter, as well as any febrile pt with no known source
  - Consider CT-PE protocol in pt with unexplained tachycardia, hypoxia, tachypnea

Seizures

- Occurs in 26% of patients after aSAH
  - Only 3-7% are delayed
- Prophylaxis not indicated
- In the event of seizure treat
- No Phenytoin
- AHA IIb–B rec for prophylaxis

Planning for discharge

- Comprehensive plan
- Close support
- Cognitive evaluations
- Rehabilitation
- Follow-up monitoring

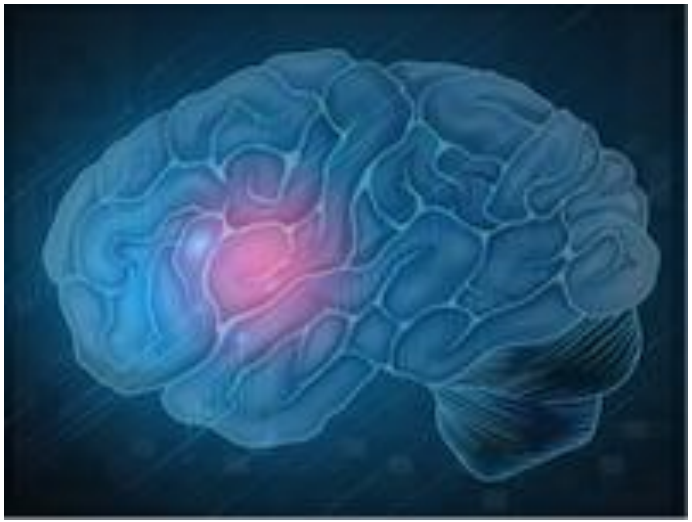
Conclusion

- Recognize that a severe HA can mean SAH – GET A CT SCAN!
- Triage to a facility best prepared to manage these patients
- Closely monitor blood pressure to prevent HTN prior to securing an aneurysm and hypotension after an aneurysm
- Monitor neurologic status closely
- Secure the aneurysm within 24 hours
- Manage fever aggressively
- Maintain euvolemia and eunatremia
- Be aware of potential cognitive/behavioral changes
- DON’T EVER LET A SUB ARACHOID FOOL YOU

Resources

- CPG – AHA Guidelines for the Management of Aneurysmal Subarachnoid Hemorrhage 2012
- The Lisa Foundation
  - Lisafoundation.org
- Brain Aneurysm Foundation
  - bafound.org
- UPMC SAH support group
- Brain Aneurysm 5K Pittsburgh – September Annually
  - Register at give.bafound.org

Thank You



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