

FERNE MEMC 2009: Optimal Treatment of Neurological Emergencies Patients

Featuring a Panel Discussion: "Care of the Ill and Agitated Patient"

William J. Brady, MD

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Acute Headache & Aneurysmal Subarachnoid Hemorrhage

How Can We Optimally Manage Patients & Exclude SAH?

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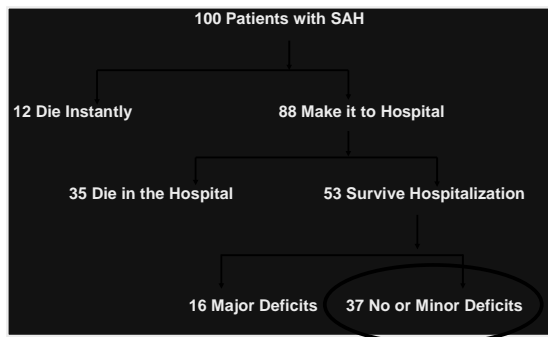
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Disclosures

None

**Aneurysmal Subarachnoid Hemorrhage
The Numbers**



**Subarachnoid Hemorrhage
Outcomes**

- Almost 50% die – immediately or after admit
- The other 50% survive.....1/3 with major deficits
- Minority return to pre-bleed function
- No significant change in outcome
 -over the past 50 years
 -despite considerable "advancements" in the management



**American College of
Emergency Physicians
Clinical Guidelines
October 2008**

**The Headache Patient
in the ED**



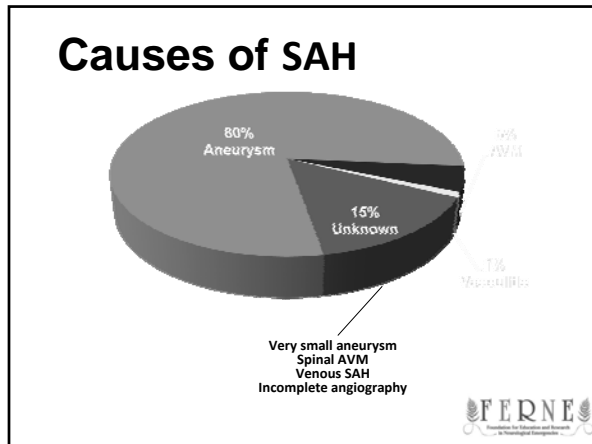
Demographics

Headache in the ED

- Common complaint -- 1 to 3% of ED visits
- ED headache with pathology -- 3 to 5%
- ED headache patients with SAH -- 0.5 to 2%
- SAH missed diagnosis
 - "Historically" reported rate -- 25-30%
 - Actual rate – 5%



Memorandum #11: Clinical Diagnosis of Aneurysmal Hemorrhage in the Emergency Department - Oct. 2009



Demographics Aneurysm & SAH

Patient Characteristics

- Mean age at presentation -- 55 years
- Gender distribution -- Female : Male
 - Aneurysm – 5 : 3
 - SAH – 1 : 1.3
 - Women have more aneurysms YET men have more SAH
- African American : Caucasian -- 2.1 : 1

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Demographics Aneurysm & SAH

- Prevalence -- aneurysm
 - up to 6% in autopsy studies (incidental)
 - up to 1% in angiographic studies (incidental)
 - Many, many, many people have unruptured intracranial aneurysms
- Annual rupture rate known aneurysm – 0.5 to 2%
- Most aneurysms NEVER rupture

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Major Risk Factors Aneurysm

- Family history (OR = 4.0) for 1st degree relatives
- Tobacco use (OR = 2.2-2.4)
- Hypertension (OR = 2.2)
- Alcohol (OR = 1.5)
- Patients with heritable connective tissue disorders also at increased risk
 - Polycystic kidney Ehlers-Danlos syndrome (Type IV)
 - Pseudoxanthoma elasticum Fibromuscular Dysplasia
- Oral Contraceptives – ? risk issue
- Cocaine (OR = ?)

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Diagnosis of SAH

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Diagnosis of SAH

- History
- Examination
- "Routine" imaging
- Lumbar puncture
- "Advanced" imaging

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Diagnosis of SAH

- **Most aneurysms are asymptomatic**
 -until they rupture with resultant SAH
 - Severe headache with N/V
 - Altered mentation
- **Symptomatic aneurysm presentation**
 - Third nerve palsy
 - Symptoms of mass lesion
 - Visual field cut



Diagnosis of SAH

- **Headache**
 - Common (85%)
 - Severe, sudden, or unusual
 - Yet "classic" presentations – not validated
 - "Worst headache of life"
 - "Sudden onset severe headache"
 - "Different from other headaches"



Diagnosis of SAH "Sentinel Headache"

- The "small" leak prior to rupture
- Older "data"
 - Up to 50% of the time
 - Very poor methodology studies
- Newer literature
 - Incidence at a significantly lower rate – 5 to 10%
- More challenging diagnosis



Polinear A: Sentinel Headaches in Aneurysmal SAH: What is the True Incidence? A Systematic Review. Cephalgia 2003

Diagnosis of SAH Headache

**Response to therapy is
NOT a discriminator**



ACEP Clinical Guidelines Oct 2008

- Does a response to therapy predict the etiology of an acute headache?
- **Level A recommendations.** None specified.
- **Level B recommendations.** None specified.
- **Level C recommendations.** Pain response to therapy should *not* be used as a diagnostic discriminator



ACEP Clinical Guidelines Oct 2008


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Diagnosis of SAH
How Good is the History & Physical Examination?

- Spectrum bias clouds results, but...
- Canadian study -- 747 patients
 - acute-onset non-traumatic HA
 - pre-test probability of SAH determined prospectively
- 50 Patients with SAH (6.7%)


Perry J, et al: Acad Emerg Med 2005



Diagnosis of SAH
How Good is the History & Physical Examination?

- Clinicians -- 85% sensitivity for SAH
 - Combined with a disease prevalence of 2%
 - Clinical judgment
 - sensitivity = 93%
 - specificity = 94%
- Very good but not enough.....


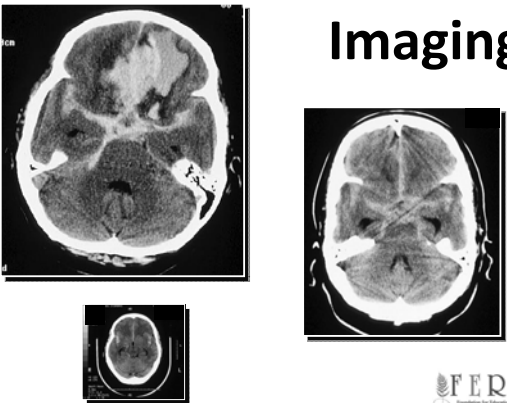
Perry J, et al: Acad Emerg Med 2005



Beyond the history & examination.....

- Head CT
- Lumbar puncture
- CT angiography
- etc.....

Imaging




Imaging in SAH

Beware SPECTRUM BIAS

CT Scan Sensitivity for SAH

- Time-dependent ability to detect
- 98-99% at 0 to 12 hours
- 90-95% at 24 hours
- 80% at 3 days
- 50% at 1 week
- 30% at 2 weeks

Depends on...
-- the volume of blood
-- the generation of scanner
-- the interpreter of the scan



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- Which patients with headache require neuroimaging in the ED?
- *Level A recommendations.* None specified.
- *Level B recommendations.*
 - 1. Patients presenting to the ED with headache and new abnormal findings in a neurologic examination (eg, focal deficit, altered mental status, altered cognitive function) should undergo emergent noncontrast head CT.
 - 2. Patients presenting with new sudden-onset severe headache should undergo an emergent head CT.
 - 3. HIV-positive patients with a new type of headache should be considered for an emergent neuroimaging study.
- *Level C recommendations.* Patients who are older than 50 years and presenting with new type of headache but with a normal neurologic examination should have imaging considered



ACEP Clinical Guidelines

Oct 2008

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CT Sensitivity for SAH

- Retrospective design
- 149 patients with SAH
- Sensitivity of 93%
 - Diagnosis via head CT
 - 139 patients – 93%
 - Diagnosis via LP
 - 10 patients – 7%



Byyny RL et al: *Annals Emerg Med* 2008

CT Sensitivity for SAH

- 5th generation CT scan
- Can newer scanners R/O SAH?
- Retrospective design / SMALL study
- 177 patients with a negative CT
- None had SAH at 3 months / 1 year



Boesiger BM et al: *J Emerg Med* 2005

Using this "CT Only" Strategy

- If you assume a 2% pretest probability
- CT sensitivity = 98% (within 12 hours)
- CT specificity = 99% (within 12 hours)
- Post-test probability of a negative CT scan = 0.04% (99.96% negative predictive value)



Consider these Numbers

Boesiger BM et al: *J Emerg Med* 2005

- These numbers sound great but.....
 - Small study
 - Few patients with SAH
 - 95% confidence interval are rather broad (61.0-100%)
 - Likelihood ratios????



Consider these Numbers

Boesiger BM et al: *J Emerg Med* 2005

- Larger, prospective studies are needed
- Do not throw away the LP kit yet!



CT-Angiography as Primary ED Strategy

- Explored the strategies: CT-angiography vs CT & LP
- 116 patients
 - 6 patients -- negative CT & positive LP – all positive CTA for aneurysm
 - 3 patients -- negative CT & negative LP – all positive CTA for aneurysm (1 negative formal angiography)



Carstairs SD: *AEM* 2006

CT-Angiography as Primary ED Strategy Some Questions.....

- False positives -- true, true, & unrelated?
- ...additional angiograms performed?
- ...unnecessary aneurysm procedures performed?
- ...such a strategy of REAL value?



Carstairs SD: *AEM* 2006

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- Does LP need to be routinely performed on ED patients being worked up for nontraumatic subarachnoid hemorrhage whose noncontrast brain CT scans are interpreted as normal?
- *Level A recommendations.* None specified.
- *Level B recommendations.* In patients presenting to the ED with sudden-onset, severe headache and a negative noncontrast head CT scan result, *lumbar puncture should be performed to rule out subarachnoid hemorrhage.*
- *Level C recommendations.* None specified.



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Lumbar Puncture

- Used to diagnose ~5% of SAH "missed" by head CT
- Historically felt to be a great secondary study
- Reality is that it is a "not particularly sensitive" test for SAH
 - Specific...yes – RULE IN
 - But sensitive...no – RULE OUT



Lumbar Puncture

- Negative LP – of significant value
- Positive LP -- real or traumatic?
 - Incidence of traumatic LP -- 10%
- LP tools to "answer" this question
 - Absolute RBC count
 - Falling RBC count from tubes 1 to 4
 - Xanthochromia



Lumbar Puncture RBC Count

- What is abnormal?
 - Dependent upon "expert" or "reference source"
 - Very sensitive vs very specific
- Absolute number of RBCs indicating a "positive" LP is controversial
 - No reliable #
 - Higher #s increasingly associated with SAH
- Neurosurgery literature suggests > 5000 RBC
- Yet numerous reports of proven SAH with RBC < 1000



Lumbar Puncture Falling RBC from Tubes 1 to 4

- Falling RBC count tube 1-4
 - Not reliable to R/O SAH
 - Not reliable to rule-in traumatic LP
 - ...and has been reported with SAH
- "There is no absolute or relative decrease that can reliably distinguish a traumatic tap from SAH"
- What about the co-existence of both SAH & traumatic tap?



Shah KH. et al: Acad Emerg Med 2003

Xanthochromia Traditional Thought

- Discoloration of spun CSF due to breakdown of hemoglobin
- Traditionally thought....
 - that negative test confirmed traumatic LP
 - to be a good discriminator of SAH from traumatic tap
 - to take 12 hours for hemolysis
 - to be very sensitive after 12 hours
 - to be very specific for SAH



Xanthochromia Sensitivity Problems

- Means to determine xanthochromia
 - Visual – commonly used / poor sensitivity
 - Spectrophotometry – rarely used / very sensitive
- Onset relative to LP (spectrophotometry)
 - 12 hours-2 weeks = 95-100% sensitivity
 - 2-3 weeks = 70% sensitivity
 - > 4 weeks = 40% sensitivity



Xanthochromia Specificity Problems

- Unfortunately value of test is now questioned....
- Can induce xanthochromia with traumatic tap

Model – RBCs into CSF in laboratory

Xanthochromia immediately apparent at RBC > 30k

Xanthochromia apparent at 1 hour at RBC > 20k

Xanthochromia apparent at 4 hours with RBC > 5k



Graves P, et al: Acad Emerg Med

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"Negative" LP Outcomes

- If LP is "positive," consider CT-A
- If LP is "negative," what's next?
- Older & newer literature very clear
 - Negative testing (CT/LP) is *extremely protective*
- Perry et al, Ann Emerg Med 2008
 - 592 patients with sudden / severe HA
 - 532 with negative CT / LP
 - ...none developed SAH at 36 month follow-up



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- Is there a need for further emergent diagnostic imaging in the patient with sudden-onset, severe headache who has negative findings in both CT and lumbar puncture?
- **Level A recommendations.** None specified.
- **Level B recommendations.** Patients with a sudden-onset, severe headache who have negative findings on a head CT, normal opening pressure, and negative findings in CSF analysis do not need emergent angiography and *can be discharged from the ED with follow-up recommended.*
- **Level C recommendations.** None specified.



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- **Level C recommendations.** None specified.



Misdiagnosed Diagnosis of SAH

Medical Contact

- ED -- 43%
- Office / Clinic -- 41%
- Hospital Admission -- 12%

Diagnostic error

- No CT -- 73%
- No LP -- 7%
- CT or LP results misinterpreted -- 16%



Kowalski: Initial Misdiagnosis and Outcome after SAH. JAMA 2004

Subarachnoid Hemorrhage

- The *least ill* patients with SAH are the *most frequently misdiagnosed.*
-
-
-
-



Subarachnoid Hemorrhage

-
- 5th generation CT is *really good*, but not good enough.
-
-
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Subarachnoid Hemorrhage

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-
- The LP does not always clarify the matter.
-
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Subarachnoid Hemorrhage

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-
- Advanced imaging may help, but it's role is unclear at this time.
-



Subarachnoid Hemorrhage

-
-
-
-
- Have a *low threshold* for more evaluation in equivocal cases.



**Many
Thanks**

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