Clinical Policy: Headache
Presenters

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Disclaimer & Disclosures

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

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Headache: Background

• Common and often a potentially high-risk complaint

• A query of the National Hospital Ambulatory Medical Care Survey for 2015 found that nontraumatic HA was identified as the 5th leading cause for ED visits, accounting for 3.8 million visits per year (2.8% of all ED visits)

• Given the complex and often undifferentiated clinical presentation of HA in the acute setting, providers must determine which patients need neuroimaging in the ED and which can be appropriately referred for outpatient evaluation

Case Study

- A 45 yo male presents with complaint of onset of headache while driving his car. He describes it as currently severe but has gradually worsened over the last 1.5 hours. He has photophobia but denies any further clinical findings including neck stiffness or other neurologic complaints. He has never really had headaches previously that he recalls...
- Physical Exam: Normal

*Do we have a tool to help support not imaging this patient?*
In the adult ED patient presenting with acute headache, are there risk-stratification strategies that reliably identify the need for emergent neuroimaging?
Primary Driver:

### Clinical Decision Rules to Rule Out Subarachnoid Hemorrhage for Acute Headache

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**Importance** Three clinical decision rules were previously derived to identify patients with headache requiring investigations to rule out subarachnoid hemorrhage.

**Objective** To assess the accuracy, reliability, acceptability, and potential refinement (i.e., to improve sensitivity or specificity) of these rules in a new cohort of patients with headache.

**Design, Setting, and Patients** Multicenter cohort study conducted at 10 university-affiliated Canadian tertiary care emergency departments from April 2006 to July 2010. Enrolled patients were 2131 adults with a headache peaking within 1 hour and no neurologic deficits. Physicians completed data forms after assessing eligible patients prior to investigations.

**Main Outcomes and Measures** Subarachnoid hemorrhage, defined as (1) subarachnoid blood on computed tomography scan; (2) xanthochromia in cerebrospinal fluid; or (3) red blood cells in the final tube of cerebrospinal fluid, with positive angiography findings.

**Results** Of the 2131 enrolled patients, 132 (6.2%) had subarachnoid hemorrhage. The decision rule including any of age 40 years or older, neck pain or stiffness, witnessed loss of consciousness, or onset during exertion had 98.5% (95% CI, 94.6%-99.6%) sensitivity and 27.5% (95% CI, 25.6%-29.5%) specificity for subarachnoid hemorrhage. Adding “thunderclap headache” (i.e., instantly peaking pain) and “limited neck flexion on examination” resulted in the Ottawa SAH Rule, with 100% (95% CI, 97.2%-100.0%) sensitivity and 15.3% (95% CI, 13.8%-16.9%) specificity.

**Conclusions and Relevance** Among patients presenting to the emergency department with acute nontraumatic headache that reached maximal intensity within 1 hour and who had normal neurologic examination findings, the Ottawa SAH Rule was highly sensitive for identifying subarachnoid hemorrhage. These findings apply only to patients with these specific clinical characteristics and require additional validation in implementation studies before the rule is applied in routine clinical care.
Ottawa SAH Decision Rule

• 2,131 pts, 132 (6.2%) had SAH

• Initial decision rule: including any of the following...
  • Age ≥ 40 years or older,
  • neck pain or stiffness,
  • witnessed LOC, or
  • onset during exertion

• Demonstrated:
  • Sensitivity 98.5% (95%CI, 94.6%–99.6%)
  • Specificity 27.5% (95%CI, 25.6%–29.5%)
Further Refining of Ottawa

• Added
  • “thunderclap headache” (i.e., instantly peaking pain) AND
  • “limited neck flexion on examination”

resulted ->

• The Ottawa SAH Rule:
  • Sensitivity of 100% (95%CI, 97.2%–100.0%)
  • Specificity of 15.3% (95%CI, 13.8%–16.9%)
Additional Class II Study
Carpenter et al.

• 17 clinical variables
• Pooled sensitivities ranged – 7% to 89% (average 39%)
  • Specificities ranged – 26% to 96% (average 74%)
• Results demonstrated none of the clinical variables used in isolation had test characteristics good enough to rule-in or rule-out SAH
Critical Question: Risk Stratification
Level B

- Use the Ottawa Subarachnoid Hemorrhage Rule (>40 years, complaint of neck pain or stiffness, witnessed loss of consciousness, onset with exertion, thunderclap headache, and limited neck flexion on examination) as a decision rule that has high sensitivity to rule out SAH, but low specificity to rule in SAH, for patients presenting to the ED with a normal neurologic examination result and peak headache severity within 1 hour of onset of pain symptoms.
Critical Question: Risk Stratification
Level B

- Although the presence of neck pain and stiffness on physical examination in ED patients with an acute headache is strongly associated with SAH, do not use a single physical sign and/or symptom to rule out SAH.
Case Study

• 45 yo male presents after having sudden onset of a “thunderclap” headache during intercourse approximately 2 hours earlier. He admits to having a history of migraines but feels this is worse.
  • Physical Exam: Normal

• You risk stratify him and determine that he needs emergent CT imaging which is obtained within the next hour and is read as negative for any SAH by both yourself and radiology

Does this patient need further testing/studies at this time?
Critical Question

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?
Surprisingly Limited Evidence

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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Findings

• Of 953 pts scanned <6 hours
  • 121 SAH identified and none missed by CT
• A few limitations but overall good study
  • SAH prevalence 7.7%
  • Sensitivity and specificity of <6h group 100%
    (95% CI of 97% to 100% and 99.5% to 100%, respectively)
• 13 pts in less than 6h CT group lost to follow-up
Supporting Evidence (Class III) but ...
Limitations of Study:

Dubosh et al. 2016

• Of the 5 studies, one was the Class II study by Perry et al discussed

• Remaining 4 studies were reviewed and received grades of “X” when reviewed individually and were not included as individual studies in the assessment of this critical question
Dubosh et al. Results

- 8,907 pooled patients in this meta-analysis
  - 13 had SAH missed on the initial CT scan
  - 11 of which were from a single study
  - Incidence of missed SAH was 1.46 per 1,000
  - Sensitivity on the CT was 98.7% (95% CI 97.1% to 99.4%) and specificity was 99.9% (95% CI 99.3% to 100%)
  - Pooled likelihood ratio of a negative CT result was 0.010 (95% CI 0.003 to 0.034).
ACEP Recommendation
Level B

*Use a normal noncontrast head CT* performed within 6 hours of symptom onset in an ED headache patient with a normal neurologic examination, to rule out nontraumatic SAH.  

*Minimum third-generation scanner.*
Case Study

• Pt is a 40 yo female who presents 7 hours after “sudden” onset of a severe headache that she says came on suddenly and now has nausea with photophobia and some neck stiffness.
  • Physical Exam: normal

• You inform patient that she will need imaging and perform a noncontrast CT scan which is negative. The patient states she is a nurse and doesn’t want a lumbar puncture, “Can you perform a different test or imaging that is just as good?”
ACEP Critical Question

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?
Computed Tomographic Angiography for the Evaluation of Aneurysmal Subarachnoid Hemorrhage

Shaun D. Carstairs, MD, David A. Tanen, MD, Timothy D. Duncan, MD, Olaf B. Nordling, MD, John E. Wanebo, MD, Thomas R. Paluska, MD, Nicholas Theodore, MD, Robert H. Riffenburgh, PhD

Abstract

Objectives: Computed tomography (CT) followed by lumbar puncture (LP) is currently the criterion standard for diagnosing subarachnoid hemorrhage (SAH) in the emergency department (ED); however, this is based on studies involving a limited number of patients. The authors sought to assess the ability of CT angiography (CTA), a new diagnostic modality, in conjunction with CT/LP to detect SAH.

Methods: Consecutive patients presenting to the ED with symptoms concerning for SAH were approached. All patients had an intravenous catheter placed and underwent a noncontrast head CT followed by CTA. Patients whose CT did not reveal evidence of SAH or other pathology underwent LP in the ED. CTAs were read within 24 hours by a neuroradiologist blinded to the patient’s history.

Results: A total of 131 patients were approached, 116 were enrolled, and 106 completed the study. In six of 116 patients (5.1%), aneurysm was found on CTA with normal CT and positive findings on LP; three had a positive CTA with normal CT and LP findings (one of which had a negative cerebral angiogram), and there was one false-positive CTA. Follow-up of all 131 patients showed no previously undiagnosed intracranial pathology. In this patient population, 4.3% (5/116) were ultimately found to have an SAH and/or aneurysm.

Conclusions: In this pilot study, CTA was found to be useful in the detection of cerebral aneurysms and may be useful in the diagnosis of aneurysmal SAH. A larger multicenter study would be useful to confirm these results.

ACADEMIC EMERGENCY MEDICINE 2006; 13:486–492 © 2006 by the Society for Academic Emergency Medicine
Carstairs et al: CT/LP vs CT/CTA

• One tertiary care medical center
• Consecutive ED patients with SAH concern
• All had Head CT & Head CTA
  • CTA results not available to ED
  • CT & CTAs by neuroradiologist
• If (-) Head CT: LP performed
• Study objective: Compare CT/LP vs CTA for diagnosis of SAH
Carstairs et al: CT/LP vs CT/CTA

- 131 patients met enrollment criteria:
  - 15 did not consent
  - 10 did not complete the study
  - 106 patients in study
- 5 cases of SAH diagnosed (4.3%):
  - CTA: (+) 5/5
  - CT/LP: (+) 2/5
  - (-) 2/5
  - LP refused 1/5
Carstairs et al: CT/LP vs CTA

- CT/LP:
  - Sensitivity: 40% (95% CI 14.7%–94.7%)

- CT/CTA:
  - Sensitivity: 100% (95% CI 47.8–100%)
CTA vs DSA

• Digital Subtraction Angiography (DSA)
  • Gold standard radiologic test
• Several studies show CTA compares well to DSA
  • El Khaldi et al; 2007 *Radiol Med*: CTA sensitivity: 99.3% (95% CI: 95.9–99.9%)
  • Menke et al; 2011 *Ann Neurol*: CTA sensitivity: 99.2% (95% CI: 97.5–99.8%)
SAH: CT/LP vs CT/CTA

• We know CT/LP is extremely sensitive for SAH diagnosis:

Is the Combination of Negative Computed Tomography Result and Negative Lumbar Puncture Result Sufficient to Rule Out Subarachnoid Hemorrhage?

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592 patients enrolled

- SAH: 61 cases (10.3%)
  - CT scan: 55 (90%)
  - LP: 6 (10%)
  - Follow-up: 0
CT/LP vs CT/CTA?

• Direct comparison of CT/LP vs CT/CTA: Only one study: data limited with only 5 total cases of SAH
• CTA’s ability to diagnose aneurysms: CTA compares favorably with gold standard (DSA)
• CT/LP is extremely sensitive for ruling out SAH
CT/LP vs CT/CTA: Other Considerations

• Favor CT/CTA:
  • Avoids an LP (invasive and uncomfortable)
  • Low diagnostic yield of LP: \( \text{NN}_{\text{LP}}: 90 \) (2008 Perry study)
  • High rate of LPs found with RBCs (approximately 35% where only one in 90 LPs are confirmed SAH): Is it a traumatic tap or SAH?
  • CSF xanthochromia: Timing and interpretation issues.
  • Shared decision making: Patients prefer CT/CTA option

• Favor LP:
  • CTA may discover an asymptomatic aneurysm which could lead to unnecessary neurosurgery
  • Increased radiation exposure
  • IV contrast exposure
  • Missed alternative diagnoses picked up with LP
Class 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.
Case Study

• 35 yo female presents with severe headache that is similar to her previous migraines.
  • Pt has no neck stiffness, LOC, and pain was gradual in onset over last several hours. She has tried OTC meds including Ibuprofen and Acetaminophen without relief. She reports that he rarely goes to doctors except when her migraines are at their worse and usually is best treated with a dose of IV dilaudid. You confirm she has had 3 visits to your ED in the last 6 months for acute cephalgia and was treated with opioids on 2 of those visits.

• This patient is clearly in discomfort but are opioids really the best choice?
Critical Question

In the adult ED patient treated for acute primary headache, are nonopioids preferred to opioid medications?
Randomized study of IV prochlorperazine plus diphenhydramine vs IV hydromorphone for migraine

ABSTRACT

Objective: To determine outcomes among patients who present to the emergency department (ED) who receive IV hydromorphone vs IV prochlorperazine plus diphenhydramine.

Methods: This study was conducted at an academic ED. Adult patients who met international criteria for migraine were eligible if they had not received an opioid within the previous month. Only patients who verbalized that they did not use an opioid within the previous month were eligible to participate. A total of 4 participants received hydromorphone 1 mg and a total of 4 participants received prochlorperazine 25 mg and diphenhydramine 25 mg. Diphenhydramine was administered to prevent the sedative side effect of IV prochlorperazine. The primary outcome was sustained resolution of headache, defined as achieving a headache level of mild or none within 2 hours of medication administration and maintaining that level for 48 hours without the requirement of rescue medication. A planned interim analysis was conducted once 48-hour data were available for 120 patients.

Results: The trial was halted by the data monitoring committee after 127 patients had been enrolled. The primary outcome was achieved in the prochlorperazine arm by 37 of 62 (60%) participants and in the hydromorphone arm by 20 of 64 (31%) participants (difference 28%, 95% confidence interval 12-45, number needed to treat 4, 95% confidence interval 2-9).

Conclusions: IV hydromorphone is substantially less effective than IV prochlorperazine for the treatment of acute migraine in the ED and should not be used as first-line therapy.

ClinicalTrials.gov identifier: NCT02389829.

Classification of evidence: This study provides Class I evidence that for patients in the ED with migraine, IV prochlorperazine + diphenhydramine is superior to IV hydromorphone. Neurology® 2017;89:2075-2082.
ACEP Recommendation
Level A

*Preferentially use nonopioid medications in the treatment of acute primary headaches in ED patients.*
Summary

• The Ottawa Subarachnoid Hemorrhage Rule can be used as a decision rule that has high sensitivity to rule out SAH within 1h of onset
  • (>40 years, complaint of neck pain or stiffness, witnessed loss of consciousness, onset with exertion, thunderclap headache, and limited neck flexion on examination)

• Do not use a single physical sign and/or symptom to rule out SAH
Summary

• Use non-narcotics and avoid opioids for ED headache management
• Use a normal noncontrast head CT performed within 6 hours of symptom onset in an ED headache patient with a normal neurologic examination, to rule out nontraumatic SAH.
• 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
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