

ACUTE HEADACHE WHEN TO SCAN ?

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DO WE SCAN TOO MUCH?

Yes!

“Don’t do imaging for acute headache unless red flags are present”

“Don’t do imaging for minor head trauma unless red flags are present”

TODAY'S TOPICS

WHEN TO SCAN:

- 1) Acute Adult Headache
- 2) Head Trauma
- 3) Pediatric Population



EP's GOAL

- Rapidly diagnose & treat life threatening conditions
- Avoid missing reversible causes

‘primum non nocere’

... first, do no harm!



ADULT HEADACHE

- 2* - 5 % of ED visits
- Patients present because
 - Unable to tolerate usual pain of recurrent headaches
 - New or different symptoms
 - “worst ever”
 - “different or more severe”
 - new symptoms

SHOULD I ORDER A CT?

PET Scan?

MRA?

MRI?

CT Angiogram?

FLAIR?
STIR?
DWI?
DTI?
PWI?
fMRI?
MRS
MTI?
3T

LUMBAR PUNCTURE?

SPECT?



CAUSES of HEADACHE: SIGNIFICANT or LIFE-THREATENING

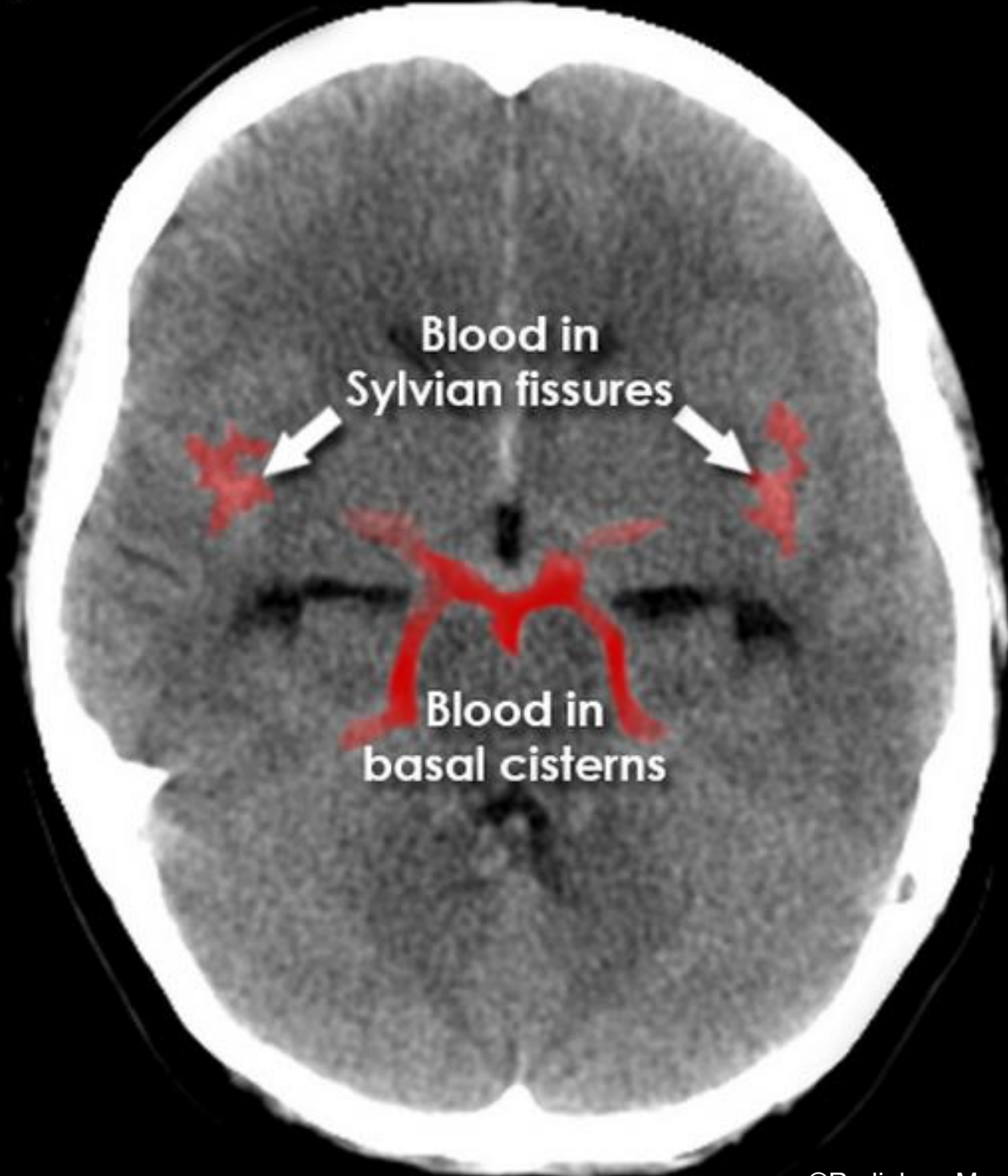
- Subarachnoid hemorrhage
- Meningitis
- Carbon monoxide poisoning
- Temporal arteritis
- Acute angle-closure glaucoma
- Intracranial hemorrhage
- Vascular



RED FLAGS ON HISTORY:

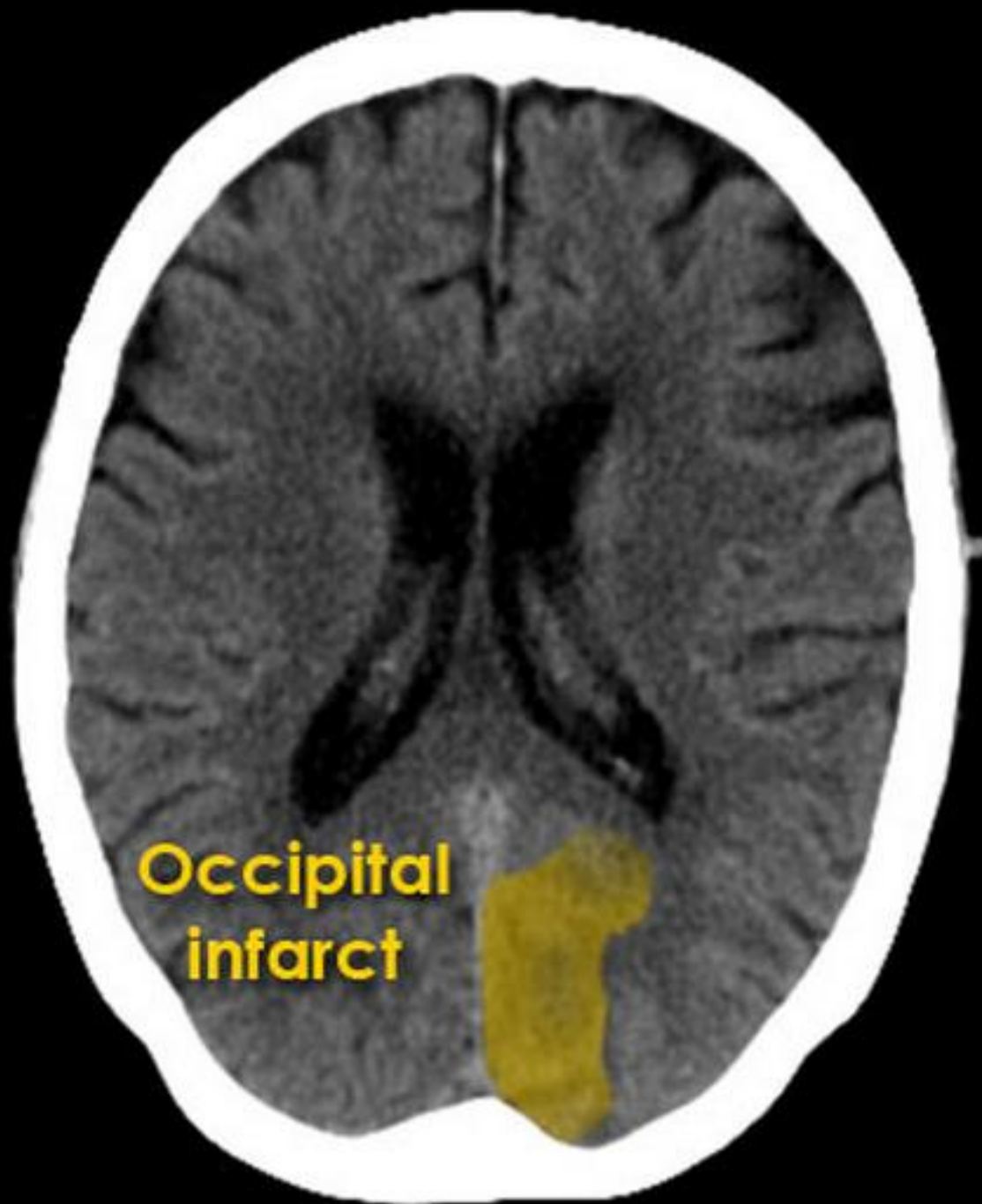
- “Thunderclap headache”
- First & worst of life
- Altered mental status or seizure
- Focal neurological symptoms
- Infectious symptoms
- Onset during exertion
- Immunocompromised / HIV
- Environmental exposure (eg CO)
- >50 with new or worsening headache
- Anticoagulated





Blood in
Sylvian fissures

Blood in
basal cisterns



**Occipital
infarct**

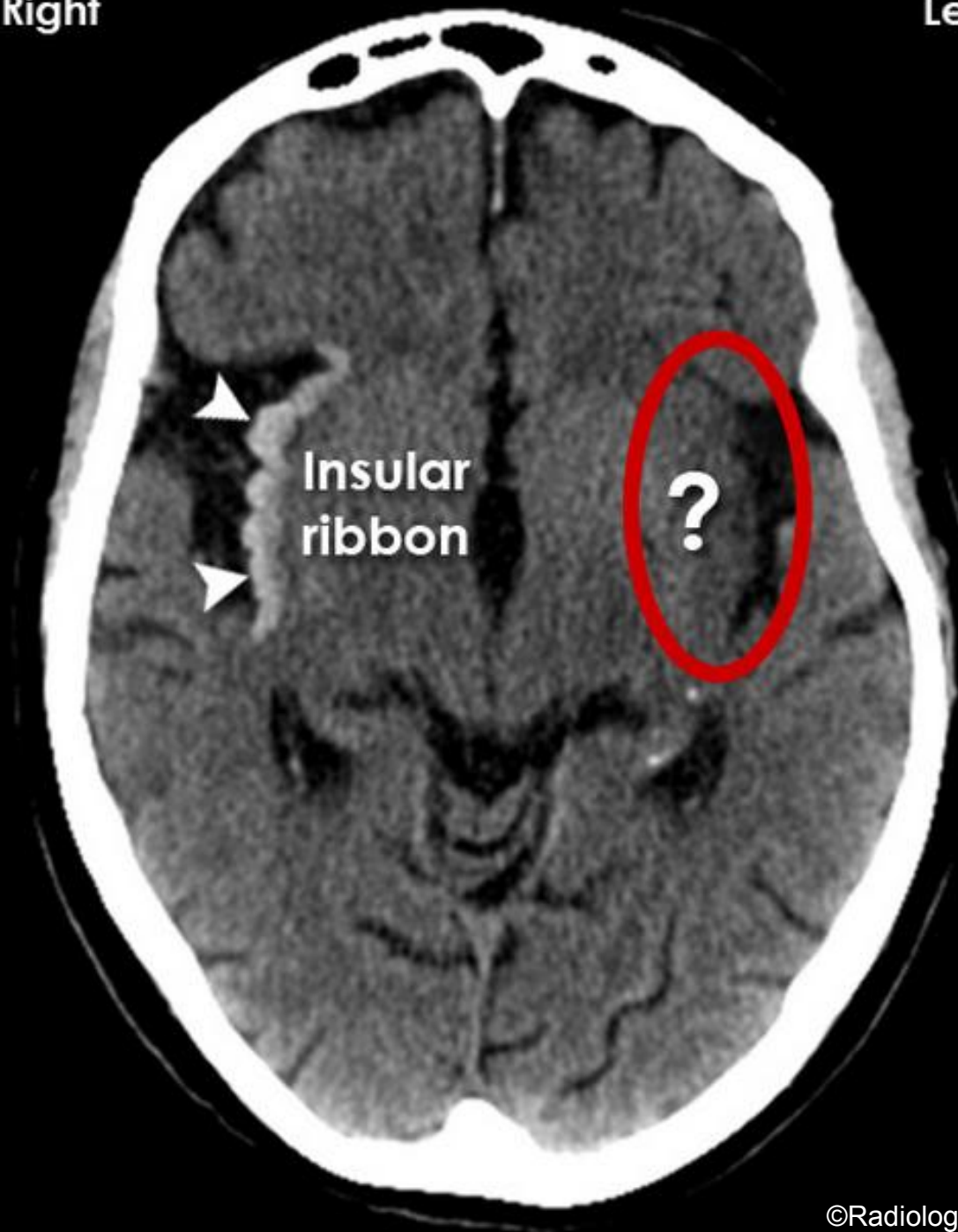
RED FLAGS ON PHYSICAL EXAM

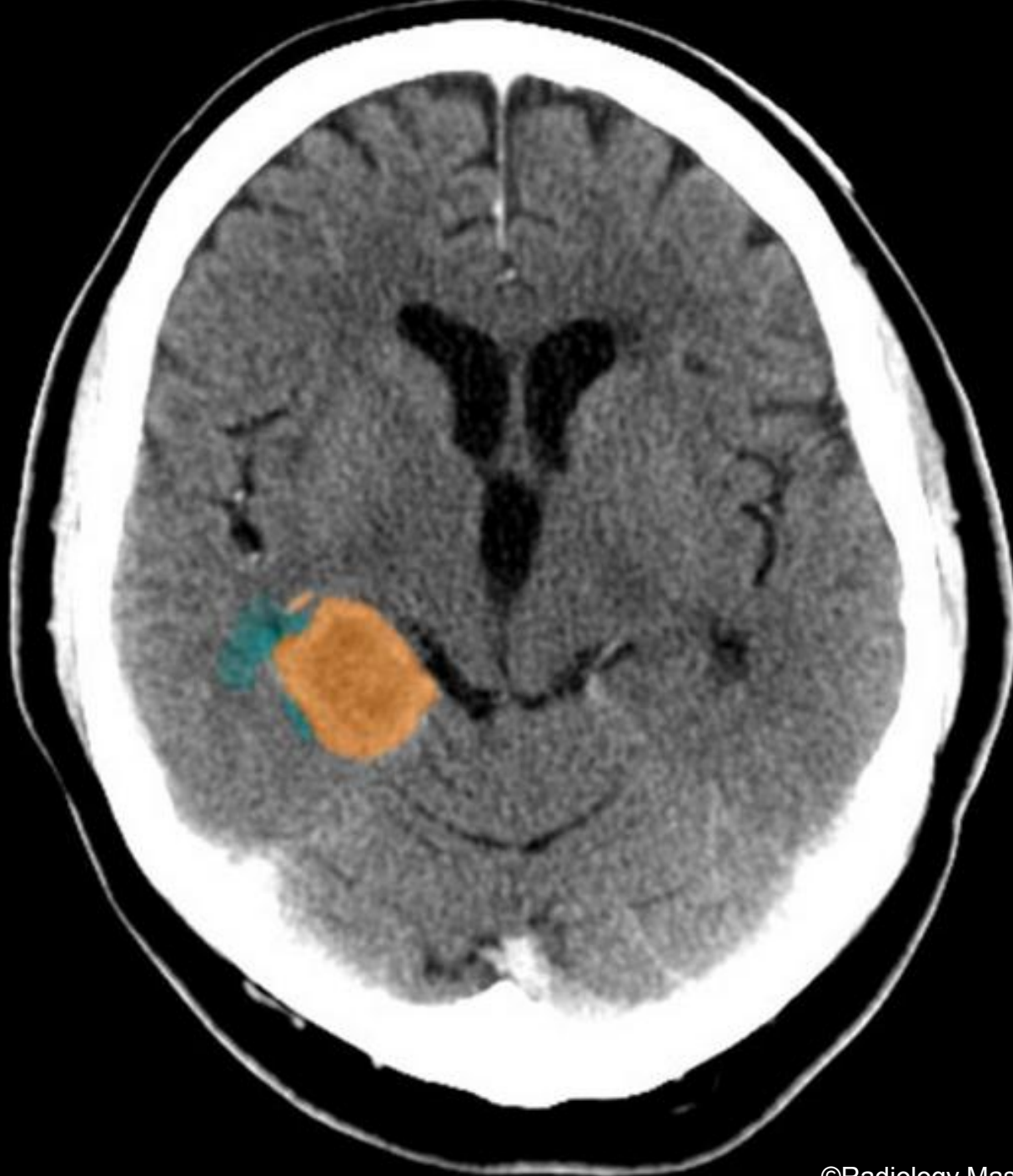
- ↓ level of consciousness
- Focal neurological findings
- Fever
- Meningismus
- Papilledema
- External signs of head trauma
- Pupils fixed, nonreactive
- Tender temporal artery



Right

Left





WHICH PATIENTS WITH HEADACHE REQUIRE NEUROIMAGING IN THE ED?

- Level B Recommendations
 - Patients presenting to the ED with headache & new abnormal neuro findings (eg altered LOC, cognitive function & focal symptoms/signs)
 - New sudden onset severe headache
 - HIV-positive patients with a new type of HA
- Level C
 - Patients > 50 with new HA but with normal neuro exam

Edlow JA, Panagos PD, & Godwin SA et al. *Clinical Policy: Critical Issues in the Evaluation & Management of adult Patients Presenting to the Emergency Department with Acute Headache.* Ann Em Med 52;4; 407 2008

CT NOT INDICATED IF:

- No significant change in typical headache pattern
- No red flags on history or physical examination
- No focal neurological findings
- No high risk comorbidity



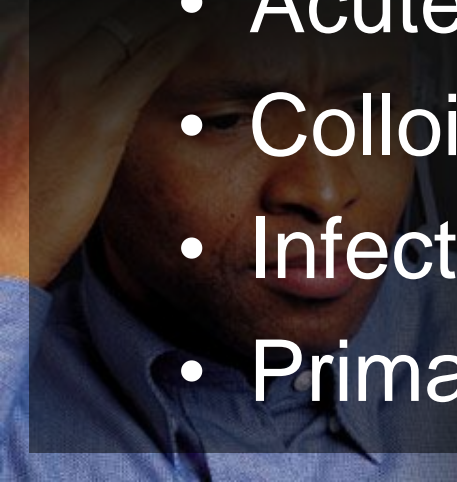
THUNDERCLAP HEADACHE

- Subarachnoid hemorrhage
- Sentinel headache
- Reversible cerebral vasoconstriction syndrome
- Cerebral venous thrombosis
- Cervical artery dissection



THUNDERCLAP HEADACHE

- Spontaneous intracranial hypotension
- Pituitary apoplexy
- Retroclival hematoma
- Ischemic stroke
- Acute hypertensive crisis
- Colloid cyst of the third ventricle
- Infections
- Primary thunderclap headache



CT TO RULE OUT SAH

- CT is 100% sensitive to rule out SAH in first 6 hours*
 - Prospective cohort study
 - Adults > 15 with acute non-traumatic headache or syncope & headache
 - Modern “third generation” CT
 - 3132 neurologically intact adults enrolled from 11 academic centres, 7.7% had SAH

*Perry JJ, Stiell IG, Sivilotti ML et al, BMJ 2011;343:d4277

Blok KM, Rinkel GJ, Hendrikse J et al, Neurology 2015 Apr 10 epub (760 patients, 7% had SAH, 99.9% neg predictive value)

OTTAWA SUBARACHNOID HEMORRHAGE RULE*

Highly sensitive for identifying SAH
(needs additional evaluation in implementation studies)

- 1) Age \geq 40
- 2) Neck pain or stiffness
- 3) Witnessed loss of consciousness
- 4) Onset during exertion
- 5) Thunderclap headache
- 6) Limited neck flexion on examination

*Perry JJ, Stiell IG, Sivilotti ML et al. JAMA 2013 Sep 25;310(12): 1248-55

OTTAWA SUBARACHNOID HEMORRHAGE RULE*

- 100% (95% CI, 97.2%-100.0%) sensitivity
- 15.3% (95% CI, 13.8%-16.9%) specificity

*Perry JJ, Stiell IG, Sivilotti ML et al. JAMA 2013 Sep 25;310(12): 1248-55

CT FOLLOWED BY CT ANGIOGRAPHY

SPECIAL CONTRIBUTION

Can Computed Tomography Angiography of the Brain Replace Lumbar Puncture in the Evaluation of Acute-onset Headache After a Negative Noncontrast Cranial Computed Tomography Scan?

Robert F. McCormack, MD, and Alan Hutson, PhD

Abstract

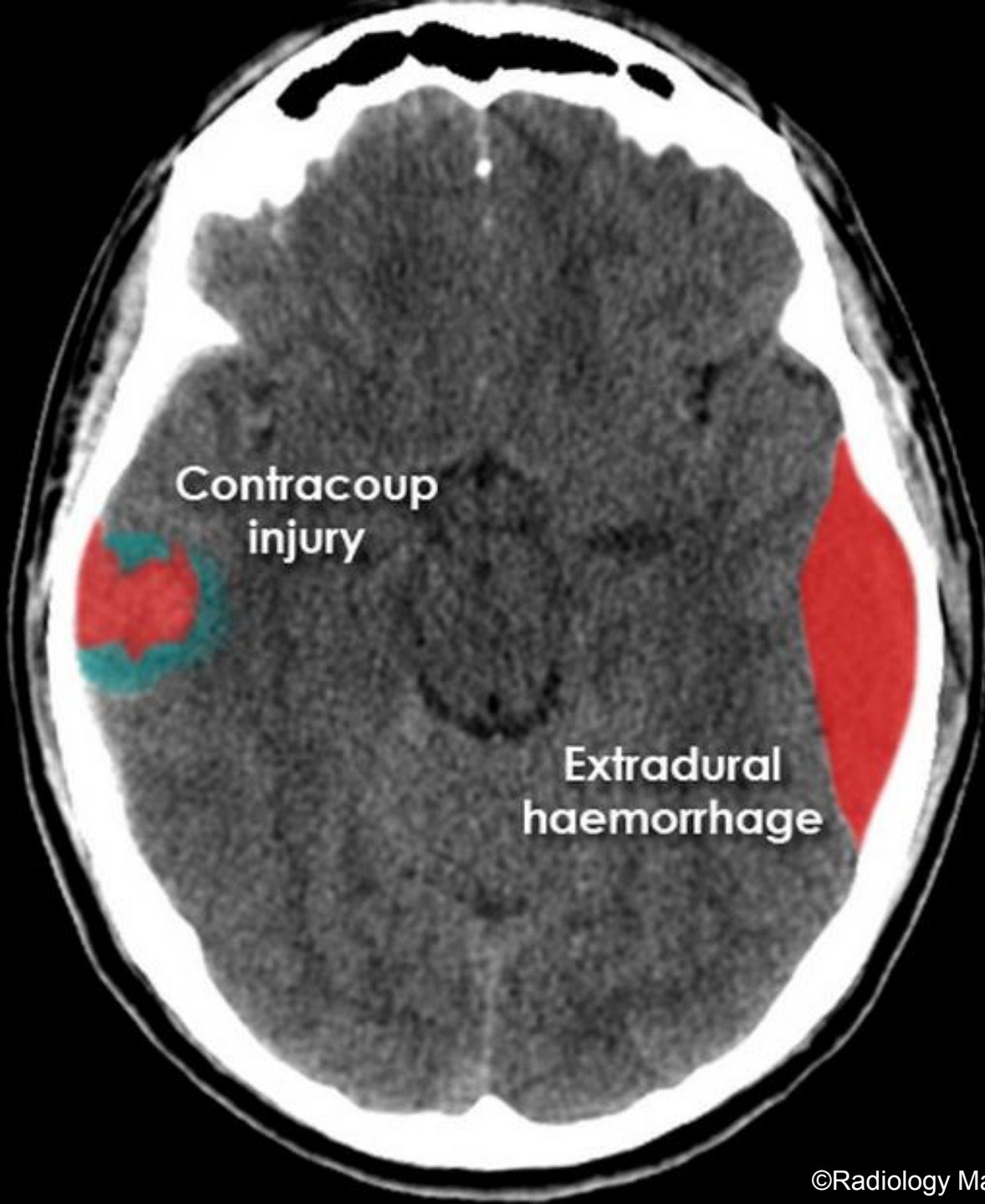
Objectives: The primary goal of evaluation for acute-onset headache is to exclude aneurysmal subarachnoid hemorrhage (SAH). Noncontrast cranial computed tomography (CT), followed by lumbar puncture (LP) if the CT is negative, is the current standard of care. Computed tomography angiography (CTA) of the brain has become more available and more sensitive for the detection of cerebral aneurysms. This study addresses the role of CT/CTA versus CT/LP in the diagnostic workup of acute-onset headache.

VARIABILITY IN PRACTICE

- Australasian survey of 878 EPs & Trainees
- Different approaches
- Especially different approaches on action after a normal ' < 6 hr CT head'
- Is CT Angiogram a better choice than LP?

HEAD INJURY





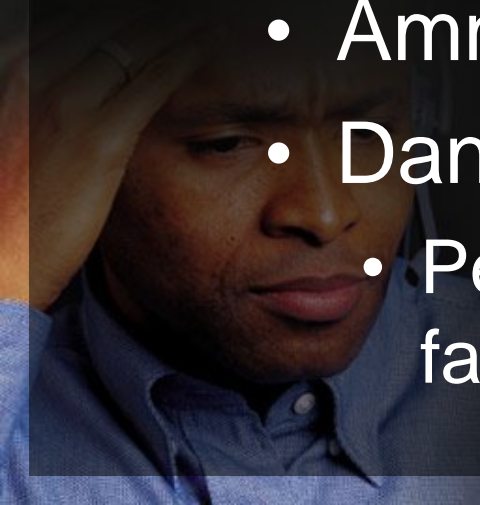
DECISION RULES FOR CT IN MINOR HEAD INJURY

- Canadian CT Head Rule
- New Orleans Criteria



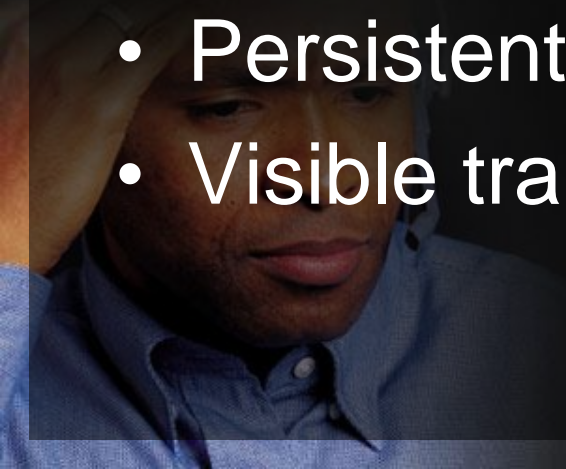
CANADIAN CT HEAD RULE

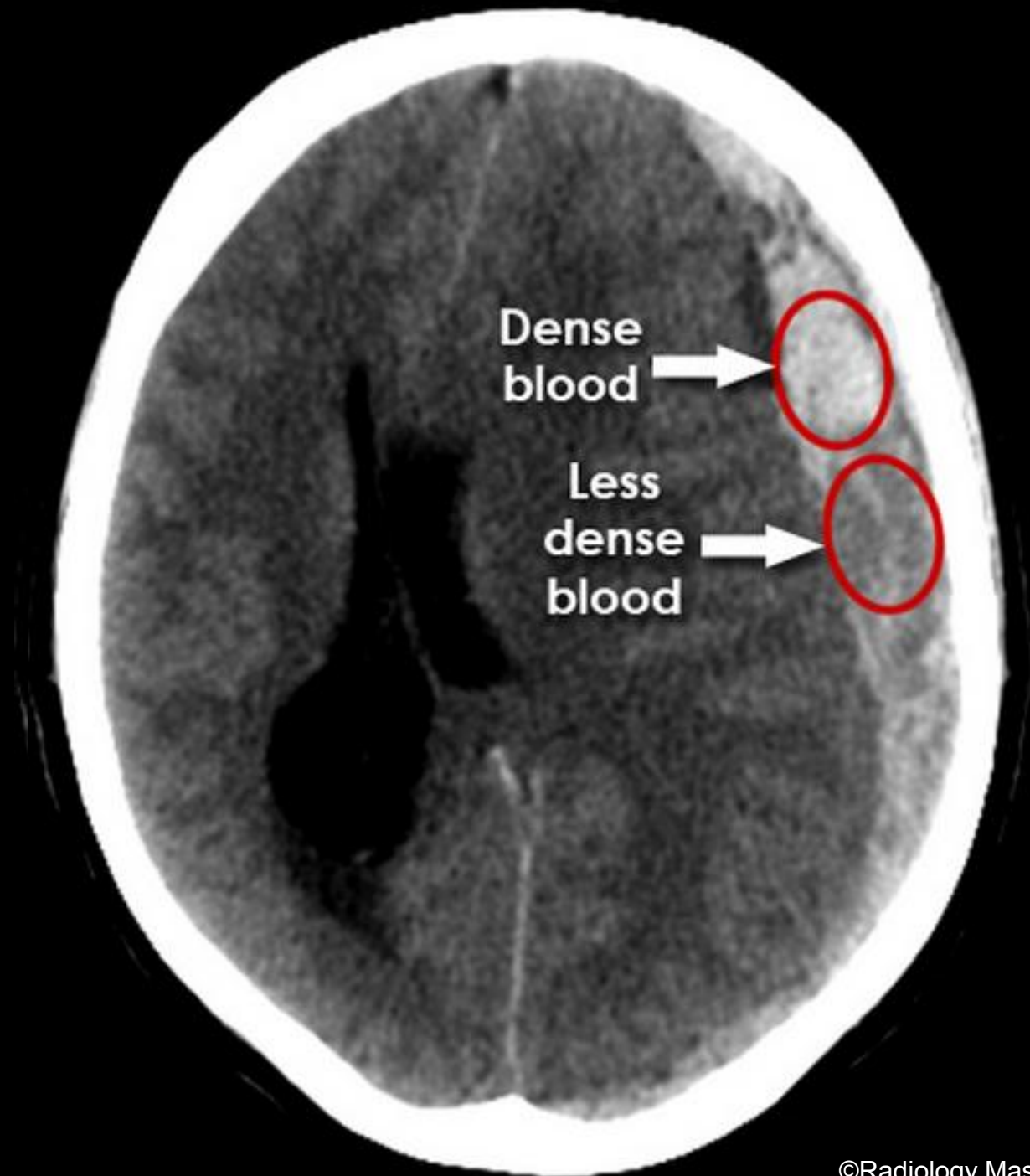
- GCS < 15 two hours after injury
- Suspected open or depressed skull #
- Sign of basilar skull #
- Vomiting >2 episodes
- Age >65
- Amnesia before impact of \geq 30 minutes
- Dangerous mechanism
 - Ped struck, ejection from motor vehicle, fall from \geq 3 feet or \geq 5 stairs



NEW ORLEANS CRITERIA

- GCS < 15 two hours after injury
- Headache
- Vomiting
- Age > 60 years
- Drug or alcohol intoxication
- Persistent anterograde amnesia
- Visible trauma above clavicle



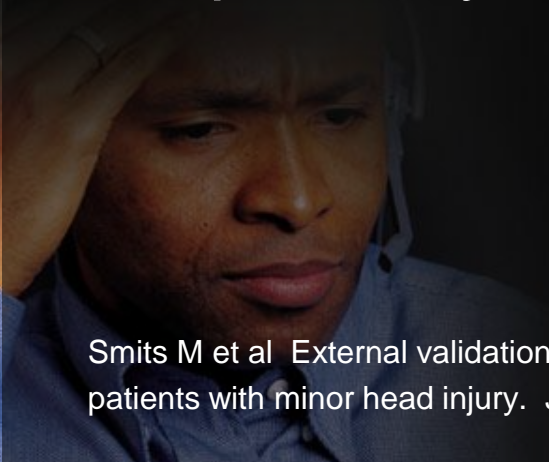


VALIDATION OF RULES

- Both highly sensitive (100%)
- Canadian CT rule more specific, resulting in lower CT rates (52.1 vs 88.0%)

VALIDATION OF RULES

- Dutch study
- 3181 patients with mild TBI
- Sensitivity NOC vs Canadian CTR: 99.4 vs 87.2
- Specificity Canadian CTR vs NOC: 39.7 vs 3.0



Smits M et al External validation of the Canadian CT Head Rule and the New Orleans Criteria for CT scanning in patients with minor head injury. JAMA 2005; 294:1519

VALIDATION OF RULES

- 1582 patients
- When GCS < 15 were excluded:
- Similar sensitivity: 93% vs 85%
- Other studies have confirmed lower specificity for New Orleans Criteria

Boulder W et al. Prediction value of the Canadian CT head rule and the New Orleans criteria for positive head CT scan and acute neurosurgical procedures in minor head trauma: a multicenter external validation study. Ann Emerg Med 2013; 61:521

RESEARCH ARTICLE

Open Access

Comparison of the Canadian CT head rule and the new orleans criteria in patients with minor head injury

Cemil Kavalci^{1*}, Gokhan Aksel¹, Omer Salt², M Serkan Yilmaz³, Ali Demir⁴, Gulsüm Kavalci⁵, Betul Akbuga Ozel¹, Ertugrul Altinbilek⁶, Tamer Durdu³, Cihat Yel³, Polat Durukan⁷ and Bahattin Isik⁸

Abstract

Aim: The aim of the study was to compare the New Orleans Criteria and the New Orleans Criteria according to their diagnostic performance in patients with mild head injury.

Methods: The study was designed and conducted prospectively after obtaining ethics committee approval. Data was collected prospectively for patients presenting to the ED with Minor Head Injury. After clinical assessment, a standard CT scan of the head was performed in patients having at least one of the risk factors stated in one of the two clinical decision rules.

Patients with positive traumatic head injury according to BT results defined as Group 1 and those who had no intracranial injury defined as Group 2. Statistical analysis was performed with SPSS 11.00 for Windows. ROC analyze was performed to determine the effectiveness of detecting intracranial injury with both decision rules. $p < 0.05$ was considered statistically significant.

Results: 175 patients enrolled the study. Male to female ratio was 1.5. The mean age of the patients was $45 \pm 21,3$ in group 1 and $49 \pm 20,6$ in group 2. The most common mechanism of trauma was falling. The sensitivity and specificity of CCHR were respectively 76.4% and 41.7%, whereas sensitivity and specificity of NOC were 88.2% and 6.9%.

Conclusion: The CCHR has higher specificity, PPV and NPV for important clinical outcomes than does the NOC.

Keywords: Emergency, Head injury, CT rules

THE PEDIATRIC POPULATION



CHILDREN

- Minimize radiation exposure
 - Only order CT for select indications
 - Consider alternatives ie MRI
 - Ultrasound in newborn & young infant
 - If CT is necessary:
 - ALARA “as low as reasonably achievable”
 - “least radiation dose necessary”
 - “Image Gently Campaign”



PEDIATRIC HEAD CT

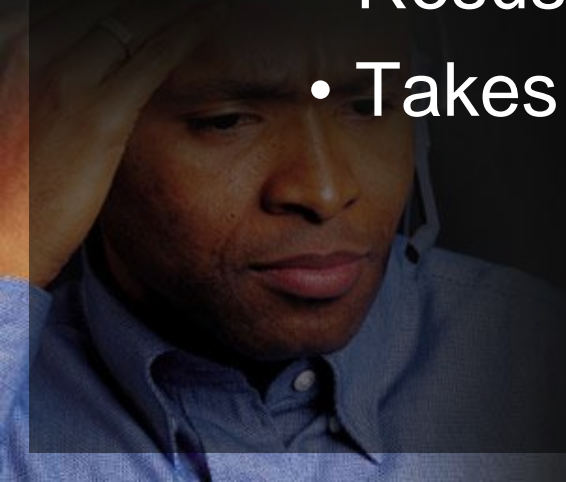
Acute or Emergency situations:

- 1) Acute trauma
- 2) Acute neurological deficit
- 3) Encephalopathy / unexplained altered or loss of consciousness



PEDIATRIC MRI

- If available, can avoid contrast CT
- Relatively non-invasive
- More sensitive & specific information
- May not be feasible
 - Resuscitation equipment
 - Takes longer – sedation



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