ARTICLE:
- Citation: “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?”
- Country: USA
- Funding Sources: none disclosed

PURPOSE:
- Research Question(s): What is / are the primary questions being addressed by this study? Usually found just before the methods.

Can CT/CTA replace our current diagnostic strategy?
- Hypothesis: What is the anticipated outcome or alternatively, the null hypothesis (there will be no difference between groups).

CT followed by CTA can replace CT followed by LP as our strategy to diagnose aneurismal SAH

DESIGN:
- Study Design:
  - Major types of quantitative designs: Descriptive (case / series) Correlational (prospective / restrospective cohort), Quasi-Experimental, and Experimental (Randomized Controlled).
  - ? prospective vs. restrospective.
  - ? blinding

Literature review followed by utilizing reported sensitivity/specificity data to make a mathematical model determining the probability of making a successful diagnosis using CT/CTA
- Dependent / outcome Variable(s): What is the variable of interest / outcome being studied.

The post test probability of successfully ruling out a SAH after a negative CT/CTA
- Independent / research Variable: What is the variable that is modified among groups?

CT/CTA vs. CT/LP
SETTING / SUBJECTS:
- Research Setting: Inpatient / outpatient, rural / urban, academic / community, EM / non-em, etc.
- Subjects: N/A

METHODS:
- Interventions: N/A
- Study Groups: N/A
- Instruments: Utilized data from studies to calculate probability models to determine the ability to r/o SAH. This method required several clinical assumptions.
- Data Collection: The authors performed the literature review and calculated the probability.

DATA ANALYSIS:
- Level of Data: Ordinal data
- Statistics Used: Mathematical probability model
- What, if any, variables were controlled for?: Variables could not be controlled for, instead clinical assumptions were set forth
  - 15% of ED patients with acute onset headache and normal neuro exam will have a SAH
  - 85% of SAH will be due to aneurysm or AVM
  - Therefore, 12.75% of ED acute-onset headache patients will have SAH due to aneurysm of AVM
  - 2.5% prevalence of aneurysm in patients without risk factors for aneurysm and without SAH
  - CT: 91% Sensitive with 95% CI 82-97% and specificity of 100%
  - CTA: 97.9% sensitive with 95% CI: 88.9-99.9% and specificity of 100%

RESULTS:
- Brief answers to research questions: Authors conclude that CT/CTA can replace the current CT/LP strategy – but only in select patients. Yet, they state this while admitting that the sensitivity is slightly lower than the current strategy
  - Negative predictive value of excluding AVM/aneurysmal SAH after negative CT/CTA is 99.43%
  - Negative predictive value is 100% after negative CT/LP

- Additional findings: The most important discussion in this paper is the discussion of risk and post test probability with our patients. Certainly, this happens too infrequently within most physicians’ practices. They suggest informed consent in patients letting them know the theoretical risk for
missing a SAH due to an aneurysm or AVM is less than 1% when you use the CT/CTA model.

- **Other possible explanation for findings:** Are their other possible / probable explanations for the results other than those presented by the authors? Do the results correspond with the purpose of the study? Consider: sample size issues, measurement issues (did they measure the right outcomes?), attrition, treatment integrity (was the intervention always delivered exactly the same way?), and other issues you identify.

- **Limitations:** Limitations do not take away from the conversation about risk of missing this diagnosis. However, there are several limitations.
  
  o They assume independence between CT/CTA. They also calculate their probability based on this. Yet, their probability should be conditional (i.e. the probability of A, given B).
  o They spend large amount of time discussing why a randomized two-arm equivalence study would be better suited to prove their hypothesis, yet they state they are unwilling to do this since the sample population would need to be huge (>3000) to achieve a great enough power.
  o They discuss the trouble with interpretation of traumatic taps to r/o SAH. Yet, they do not discuss the reliability of the clinician/radiologist reading CT scans to r/o small bleeds.
  o It is dangerous to suggest a less harmful strategy to rule out SAH when in fact by scanning their head twice, and by subjecting them to contrast, we may in fact be causing more harm than good. Also, what does a clinician do when faced when a small unruptured aneurysm. Does that patient now undergo neurosurgical intervention, placing them at additional risk, when they should have simply continued to control their blood pressure and assess for increasing size in the future?

**IMPLICATIONS FOR PRACTICE:**

- **Applicable to this clinical practice:** The discussion of risk is applicable to our practice. When possible, we should discuss tests with patients and obtain informed consent. Physicians need to work on discussing risks/probability/etc. with patients that may not have suitable numerical literacy.

- **Feasible (cost, resources, etc):**
- **Clinically Relevant:** I do not believe the data is sufficient enough to change our clinical practice.

**LEVEL OF EVIDENCE / DECISION FOR USE:**

- Background
- Consider Replication
- Ready for use
Consider Replication / RCT

- **Level of Evidence:**
  - Ia Evidence obtained from meta-analysis of randomized controlled trials
  - Ib Evidence obtained from at least one RCT
  - IIa Evidence obtained from at least one well-designed controlled study without randomization
  - IIb Evidence obtained from at least one other type of well-designed quasi-experimental study
  - III Well-designed non-experimental studies
  - IV Expert committee reports, opinions of experts