

## Journal Club Synopsis for Block 2

Topic: In suspecting aneurysmal subarachnoid hemorrhage, is the “gold standard” CT/LP the safest modality for patient care?

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### Clinical Scenario:

We started our JC with a clinical scenario regarding a 39 year-old smoker male presenting 2 hours PTA with complaints of a severe, sudden “worse headache of life” while at work. Vitals signs are stable and no focal neuro deficits on exam. After attempting to give him pain medications without any relief, you decide to order a CT scan. After reevaluating the patient, he still is in extreme pain and you are still concerned. LP is next, right? As you are explaining the risks of the LP and concerns for SAH to your distraught patient, you think “Is this LP necessary?” Are there any other good measures and data to rule out SAH besides additional LP?

Article #1: McCormack, R.F., et al (2010) Acad Emerg Med 17(4):444. 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?

This paper was a retrospective literature review search of 6 pertinent articles looking at CT/CTA sensitivity in ruling out SAH rather than the CT/LP method. This was done because an equivalence study comparing CT/LP and CT/CTA would require >3,000 patients. From these selected papers, this article constructed a mathematical probability model to determine the posttest probability of excluding SAH with a CT/CTA method which was around 99.43% (95% CI = 98.86% to 99.81%).

Limitations: First, you are talking about a lot of radiation and the risk of contrast media-induced reactions with this strategy. Second, this recommendation is based on a mathematical model and has never been tested. Third, we know that 2-3% of a typical middle-aged population harbors asymptomatic intracranial aneurysms. If one were to follow this proposed strategy of negative head CT followed by CT angiography and an aneurysm is discovered, a lumbar puncture would have to be performed anyway to determine whether it is symptomatic. If the aneurysm is not bleeding and was found incidentally, you have another problem—what are you going to do with an asymptomatic aneurysm? The overwhelming number of these small aneurysms (smaller than 5 mm) will never rupture, but will likely result in significant patient anxiety and neurosurgical consultation. If the neurosurgeon elects to intervene, you can expect a 2 percent mortality rate and 11 percent morbidity. Literature review looked at mostly retrospective reviews for CT diagnosing SAH and CTA diagnosing aneurysms; not prospective. CTA may detect an aneurysm that may not be related to headache. Also, with a negative CT seen in our patients, exposing to possibly harmful additional tests and procedures in the future.

Bottom line: I had my reservations about this study. First it chose CT as the “gold standard” for ruling out SAH which does work with our search of CT/LP gold standard. Second, the study took in the mostly retrospective studies and data and presumed a mathematical model from basically fake study data to deal with a life threatening issue. Lastly, the risks of inadvertently using CTA on headache patients can do more harm than good.

Article #2: Brunell, A., et al, (2013) Journal of Neurology. 206 (6), 1631-1636. DIFFERENTIAL DIAGNOSTIC YIELD OF LUMBAR PUNCTURE IN INVESTIGATION OF SUSPECTED SUBARACHNOID HAEMORRHAGE: A RETROSPECTIVE STUDY.

This retrospective study of 450+ patients in a single tertiary institution in Sweden looked at performing LPs after CTs performed in outpatient/ED settings to evaluate for any evidence of diagnosing significant aneurysmal SAHs. 34% were admitted for pending LPs after inconclusive CT scans. 3% of patients had received an alternative diagnosis with the majority being aseptic meningitis.

Limitations: This study was retrospective leading itself to increased risk for inaccurate records. Spectrum bias was noted which the CT/LP can perform differently in different patient populations. There appeared to be inconsistencies in data collection such as unnamed data collectors or training, not blinded to the study's hypothesis. What I didn't like about the study specifically classify "normal neuro exam" or what "mildly abnormal neurological examination". Yet, the article tried to include patients with normal neuro exams with headache. What I found interesting is that with the 450 patients that had CT/LP for SAH, none had significant aneurysmal SAHs.

Bottom line: Poorly based article and wouldn't hang anything on this one. The main reason this article was discussed is the majority of the data for this specific topic (SAH diagnosis) that have been used for clinical guidelines are based either on retrospective data or on prospective data using ill patients with overt neurological deficits and high risk (i.e the highly used Morgenstern et al article in 1998 published in Annals of EM with 455 patients). Also, LPs were useful in diagnosing other causes for severe headache that could be a concern (i.e meningitis).

Article #3: Perry, J.J., et al, (2011) Br Med J 343:d4277. SENSITIVITY OF COMPUTED TOMOGRAPHY PERFORMED WITHIN SIX HOURS OF ONSET OF HEADACHE FOR DIAGNOSIS OF SUBARACHNOID HAEMORRHAGE: PROSPECTIVE COHORT STUDY.

In this prospective study conducted in 11 tertiary care EDs across Canada, sensitivity of head CT for the diagnosis of SAH was evaluated in 3132 consecutively enrolled neurologically intact adult patients presenting with new acute HA peaking within one hour of onset. SAH rate was 7.7%. Sensitivity of CT for SAH was 92% (95% CI 89-95.5%), with a specificity of 100% (trying to identify specificity is silly here due to incorporation bias-if you define a "positive" using a test you're evaluating (i.e blood in the brain is definite diagnosis for SAH), it had to be 100% specific). The reason this paper received so much attention is that 953 patients receiving CT within 6 hours of HA onset, CT sensitivity was 100% (95% CI 97-100%). All patients were scanned using third generation multi-slice CT scans.

Limitations: Only half the patients received LP after a negative CT and the adequacy of the follow-up has been questioned. One patient ultimately diagnosed with SAH who had CT within 6 hours of HA onset was sent home after CT was read as negative by the ED physician and radiology trainee. Additionally, 2292 potentially eligible patients were not enrolled. External validity questioned-will this hold up outside of academic centers?

Bottom line: This article offers support for CT without LP when considering SAH, if CT is performed on a modern scanner within 6 hours of HA onset and read by "qualified radiologist". That being said, there are nationally respected EPs with widely divergent opinions on whether this study is good enough for full prime time.

Bottom Line: After much debate, CT/LP as "gold standard" for SAH diagnosis is still standard of care according to recent ACEP guidelines. Although, I believe, with newer generation CT scans complied with clinical risk assessment tools, this practice will soon change.