Emergency physicians increasingly using computed tomography cerebral angiography in place of lumbar puncture for headache evaluations, resulting in increased detection of unruptured intracranial aneurysms.

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| Challenge | **There is ongoing clinical debate over the appropriateness of using computed tomography cerebral angiography (CTCA) as a substitute for lumbar puncture (LP) in the evaluation of headache with clinical concern for subarachnoid hemorrhage (SAH) in the setting of a non-diagnostic head CT. A majority of surveyed US emergency physicians favor the use of CTCA in this scenario, but recently published AHA/ASA clinical guidelines discourage the use of CTCA and strongly recommend LP as the only validated approach.** |
| Existing Evidence | Aside from indirect data concerning the relatively high sensitivity of CTCA for detection of cerebral aneurysms as compared to invasive cerebral angiography (upwards of 95%), there is essential no data concerning the clinical safety and impact of using CTCA instead of LP in the evaluation of possible SAH, aside from a 2006 prospective study of 105 patients who underwent both CTCA and LP, in which there were two cases of LP+ SAH, both of which had aneurysms detected by CTCA. |
| Target Population | Adult (> 17 years) KPNC health plan member emergency department patients with a chief complaint of headache, presenting between 2015 and 2021. Exclusions were prior diagnoses of subarachnoid hemorrhage, unruptured intracranial aneurysm, cerebral arteriovenous malformation, or cerebrospinal fluid shunt. |
| Intervention or Exposure | CTCA and/or LP during the ED encounter. |
| **Outcomes/Key Findings** | Primary and secondary outcomes were 14-day and 90-day unruptured intracranial aneurysm detection, respectively. Safety outcomes were missed diagnoses of subarachnoid hemorrhage or bacterial meningitis.  **There was a six-fold increase in the use of CTCA relative to LP between 2015 and 2021, resulting in a small increase in the detection of unruptured intracranial aneurysms, but no changes in missed diagnoses of SAH or bacterial meningitis.**  CTCA use increased annually (+18.8%/year, 95% CI +17.7% to + 20.3%) with corresponding annual decreases in LP use (-11.1%/year, 95% CI -12.0% to -10.4%). This shift in diagnostic practice was associated with an increase in unruptured intracranial aneurysm detection (+3.5%/year, 95% CI +0.9% to +7.4%), though only half of these were documented within the problem list. Subarachnoid hemorrhage (n = 1004) and bacterial meningitis (n = 118) were misdiagnosed in 5% and 18% of cases, respectively, with no annual trends (p = 0.34 and 0.73, respectively). |
| **Resulting Action/Change** | 1. **Improve percentage of unruptured intracranial aneurysms noted on problem list, ideally using a system similar to that used for incidental findings on CT body imaging.** 2. **Ensure appropriate use of second-line testing (i.e. CTCA or LP) for SAH. This will require regional guideline development and would benefit from point-of-care clinical decision support.** |
| Additional Recommendations | * + 1. Implement and endorse validated clinical tools (Ottawa SAH rules)     2. Create prospective data collection mechanisms for internal validation and refinement of guidelines. |
| Implementation Tools | 1. Chiefs of neurosurgery, neuroradiology, and emergency medicine; IMAGAC committee 2. Future development of RISTRA clinical decision support module for headache diagnostics and management. |
| Implementation Measurement | 1. Proportion of unruptured intracranial aneurysms reported on CTCA (as determined by natural language processing algorithm developed in this study) ultimately documented on the problem list. 2. Proportion of detected unruptured intracranial aneurysms with follow-up recommended imaging studies within 2 years, as per existing regional guidelines. 3. Annual tracking of CTCA use among emergency department adults with headache. |
| Reference |  |