Thunderclap Headache With Normal CT and Lumbar Puncture
Further Investigations Are Unnecessary: Against

Michael Moussouttas, MD; Stephan A. Mayer, MD

Why? Because it’s just not that simple. Thunderclap headache, typically considered synonymous with aneurysmal subarachnoid hemorrhage (SAH), can also be a nonspecific presentation for a variety of other vascular and nonvascular central nervous system processes. In addition to SAH, a large number of conditions can present with an explosive headache and a normal head CT (Table).1,2 For most of these conditions the diagnosis rests on the performance of additional investigations. Cerebrovascular imaging studies such as magnetic resonance angiography, CT angiography, or catheter angiography are essential for diagnosing cerebral or arterial dissections, vasospasm, arterial occlusions (when early CT demonstrates no evidence of ischemia), vasculitis, and aneurysms. MR venography, CT venography, and venous phase angiography may confirm dural sinus thrombosis or cortical vein thrombosis. Finally, routine MRI can readily identify hemorrhagic or ischemic pituitary apoplexy as well as posterior circulation vasogenic edema from hypertensive crises, and fat-suppression techniques have become the gold-standard for visualizing intramural hemorrhage related to dissection.

The clinical relevance, risk-justification, and cost-effectiveness of a diagnostic test rests on whether or not patient management will be affected, and on the pretest probability of revealing a significant finding. Performance of follow-up studies in cases of CT- and lumbar puncture–negative thunderclap headache is not required in all cases, but should be guided primarily by elements of the history, physical examination, and ancillary testing that suggest a specific disorder. For instance, it is reasonably well-accepted that if headache symptoms are characteristic of migraine, an extensive brain-imaging work-up is not indicated.3

A question of particular importance is whether catheter angiography is required to definitively exclude a symptomatic but unruptured intracranial aneurysm. In fact, the term “thunderclap headache” was originally coined to describe what was believed to be the presenting symptom of an unruptured cerebral aneurysm,4 and it was subsequently suggested that aneurysms may present with sudden severe head pain as a result of morphological expansion, luminal thrombosis or intramural hemorrhage.5 The literature dealing with this question has yielded conflicting results. A retrospective study of unselected patients presenting with thunderclap headache concluded that angiography is indicated in all patients with sudden severe head pain and normal clinical, CT, and cerebrospinal fluid (CSF) findings.5 A subsequent prospective study, however, demonstrated that patients with thunderclap headache and a normal examination, CT and lumbar puncture almost never go on to develop SAH, thus supporting the opposite conclusion.6 Nonetheless, cases of thunderclap headache related to a symptomatic unruptured intracranial aneurysm are well-documented.7 The clinician is usually left to rely on his or her own intuition and clinical suspicion when deciding how aggressively to pursue this diagnosis.

Another possible approach to diagnosing a trace amount of hemorrhage into the CSF of an intracranial aneurysm is CSF spectrophotometry. Even when the CSF appears clear to the human eye, CSF spectrophotometry remains 100% sensitive for detecting SAH when analyzed between 12 hours and 2 weeks from the time of ictus.8 In cases where imaging or laboratory results are equivocal, when minor cranial nerve deficits are discovered, or if there is compelling reason to exclude aneurysmal rupture (past medical or family history of aneurysm, SAH, connective tissue disorder, or polycystic kidney disease), noninvasive imaging with magnetic resonance angiography or CT angiography can be performed.8 These studies carry minimum patient risk (in contrast to the 1% risk of symptomatic cerebral ischemia from angiography), and have been shown to be over 90% sensitive for detecting aneurysms >5 mm.8 Importantly, large prospective studies of patients with unruptured aneurysms have demonstrated very low rates of SAH for aneurysms <7 mm in diameter (~0.1% per year).9

So where do we stand? It is generally recommended that all patients presenting with acute severe head pain be evaluated for the possibility of SAH with cerebral CT imaging, and
lumbar puncture (if needed) that includes measurement of opening pressure and examination for xanthochromia. Nausea and vomiting, nuchal rigidity, diplopia, impaired consciousness, and seizures are the best predictors of a positive CT in these cases, but of course clinical symptoms alone are never sufficient to rule the diagnosis in or out.10,11 If the CT and lumbar puncture are negative for obvious SAH, MRI and (depending on the clinical scenario) magnetic resonance angiography or MR venography imaging, or digital subtraction angiography should be considered, depending on the situation. Of utmost importance for the clinician is maintaining an awareness of the various conditions that can present with sudden severe headache.12

## Reference

### Table. Conditions That Can Present With Thunderclap Headache and a Normal Normal CT Scan

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<thead>
<tr>
<th>Condition</th>
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<tr>
<td>Dural sinus thrombosis</td>
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<td>Expansion or thrombosis of an unruptured intracranial aneurysm</td>
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<td>Pituitary apoplexy</td>
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<td>Dissection of the cerebral or cervical arteries</td>
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<td>Hypertensive crisis</td>
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<td>Posterior reversible leukoencephalopathy syndrome</td>
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<td>Sympathomimetic-induced vasospasm</td>
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<td>Cerebral vasculitis</td>
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<tr>
<td>Vasoconstrictive angioapathies (postpartum, exertional, coital)</td>
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<td>Spontaneous intracranial hypotension</td>
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<tr>
<td>Viral or bacterial meningoencephalitis</td>
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<td>Sphenoid sinusitis</td>
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S.A.M. reports receiving speaking honoraria and consulting fees from PDL Biopharma, and research grant support, speaking honoraria, and consulting fees from Novo Nordisk A/S.

## Disclosures

### References

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Stroke. 2008;39:1394-1395; originally published online March 6, 2008;
doi: 10.1161/STROKEAHA.107.503169
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0039-2499. Online ISSN: 1524-4628

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World Wide Web at:
http://stroke.ahajournals.org/content/39/4/1394

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