



# Expanding the Differential of Thunderclap Headache Beyond Subarachnoid Hemorrhage: A Case Report

**Urgent Message:** Cerebral venous thrombosis is a serious cause of headache that can present in a variety of manners, including sudden-onset or “thunderclap” fashion.

Caroline S. Mifsud, MS-4; Jordan L. Jones, MS-4; Michael B. Weinstock, MD

**Citation:** Mifsud C, Jones J, Weinstock M. Expanding the Differential of Thunderclap Headache Beyond Subarachnoid Hemorrhage: A Case Report. *J Urgent Care Med.* 2024; 18(8):21-24

**Key Words:** dural sinus thrombosis, cerebral venous thrombosis, headache, thrombophilia, case report

## Abstract

**Introduction:** Acute headache is among the most frequently encountered urgent care (UC) presentations. The patient in this case presented with a severe headache and ultimately was diagnosed with a cerebral venous thrombosis (CVT).

**Clinical Presentation:** A 50-year-old man presented to the emergency department (ED) after he developed a sudden onset of a severe headache that occurred immediately after sexual intercourse. He described the headache as “the worst headache of [his] life” and endorsed new-onset unilateral vision changes and leg weakness.

**Physical Exam and Laboratory Findings:** The patient was hypertensive, but otherwise he had normal vital signs on presentation. His neurologic exam was non-



focal and normal except for some mild weakness of the left lower extremity. He appeared uncomfortable. Initial labs showed only elevated glucose.

**Case Resolution:** Computed tomography (CT) angiography of the brain revealed a filling defect in the right transverse sinus consistent with dural sinus thrombosis. The patient was treated with heparin with subsequent

**Author Affiliations:** Caroline S. Mifsud, University of Pikeville Kentucky College of Osteopathic Medicine, Pikeville, Kentucky. Jordan L. Jones, University of Pikeville Kentucky College of Osteopathic Medicine, Pikeville, Kentucky. Michael B. Weinstock, MD, Adena Health System; The Wexner Medical Center at The Ohio State University; Ohio Dominican University; *The Journal of Urgent Care Medicine*. The authors have no relevant financial relationships with any commercial interests.

improvement in his symptoms and was discharged to follow-up as an outpatient.

**Conclusion:** Headaches can suggest a variety of diagnoses, ranging from benign to life-threatening. This case highlights the importance of considering diagnoses other than subarachnoid hemorrhage (SAH) for the chief complaint of the severe, “thunderclap” headache.

### Introduction

The term “cerebral venous thrombosis” (CVT) encompasses both dural sinus and cerebral vein (cortical and deep vein) thrombosis.<sup>1,2</sup> In this text, we will use “CVT” for consistency.

CVT most commonly presents as a new onset headache, however, the clinical presentation is highly variable. The most common risk factors for CVT include hereditary or acquired thrombophilia, prothrombotic states of pregnancy and the postpartum period, and malignancy.<sup>3</sup> However, risk can be increased in children with head and neck infections including otitis media, mastoiditis, and sinusitis.<sup>4</sup> CVT is more common in women and patients under 50 years of age.<sup>5</sup>

### Clinical Presentation

**History of Present Illness:** A 50-year-old male presented complaining of a sudden onset of “the worst headache of [his] life” as well as new-onset unilateral lower extremity weakness and vision changes. He described the headache as a sudden, intense pressure sensation immediately after having had an orgasm during sexual intercourse 4 hours earlier. He reported intermittent headaches over the previous several months that were less severe.

**Past Medical History:** History included hypertension, anxiety, depression, hypothyroidism, and type 2 diabetes mellitus (DM2). He did not take antiplatelet agents or anticoagulation. He denied history of stroke or venous thromboembolism (VTE). He denied tobacco use but did drink “a case of beer on the weekend.”

**Physical Exam, Laboratory Findings, and Imaging:** The patient appeared to be in significant pain. He was afebrile and had normal vital signs except for a blood pressure of 170/103. His neck was supple and nontender, and there was no evidence of head trauma. The cardiopulmonary and remainder of his general exam were normal.

On neurological assessment, the patient was alert and oriented. Cranial nerve and pupillary assessment were unremarkable. Sensation and coordination testing were also normal. Strength was full and symmetric in

the bilateral upper extremities, however, he had limited ability to maintain his left leg elevated off the bed compared to the right leg.

### Differential Diagnosis

The differential diagnosis for acute headache presentation is expansive and includes: primary headache disorders (eg, migraine, cluster headache, tension headache); structural etiologies of secondary headache (eg, neoplasm, hemorrhage, aneurysm); ocular pathology (eg, acute angle-closure glaucoma, iritis); vascular disorders (eg, carotid or vertebral artery dissection, cerebral vasoconstriction); central nervous system infections (eg, meningitis, encephalitis); extra-cranial infections (eg, otitis externa, sinusitis); hemorrhagic and (somewhat less commonly) ischemic cerebrovascular accident; certain toxins (eg, carbon monoxide, alcohol); and CVT.

### Evaluation, Medical Decision Making, and Disposition

Given the severe and sudden-onset nature of the headache described by the patient, the initial concern would be for SAH, or other spontaneous intracranial hemorrhage (ICH), as well as carotid or vertebral artery dissection. The patient was evaluated in the ED, where a complete blood count (CBC) and a complete metabolic panel (CMP) were obtained and were found entirely normal other than a glucose of 243 mg/dL. A CT angiogram of the head and neck was obtained based on concern for SAH and/or cervical artery dissection given the sudden onset nature of the headache. This imaging study was negative for hemorrhage or arterial dissection but incidentally showed a filling defect in the right transverse sinus, concerning for CVT.

### Management and Case Resolution

The patient was admitted to a medical bed and started on anticoagulation with heparin. After the initiation of heparin, the patient noted subsequent improvement in his headache, unilateral leg weakness, and vision changes. Upon further questioning during his hospitalization, the patient revealed that his daughter had a clotting disorder was on long-term anticoagulation as well. He was discharged to home on anticoagulation.

### Discussion

Headache disorders are widespread with a worldwide prevalence of 46% in adults, and the most common etiologies are tension-type and migraine headache.<sup>6</sup> Thus, it is no surprise that headaches are a very common presenting complaint in the UC setting.<sup>7</sup> UC centers are well suited to provide care to patients suffering from

headaches given that most are benign and present unpredictably. Although there is little data available on the utilization of UC for patients with headache, the utilization of ED for headache care is common with headaches accounting for 3.5 million visits annually in the United States.<sup>8,9</sup>

Using a tool or mnemonic to screen for “red flags” that suggest a higher risk for dangerous etiologies of headache may help UC clinicians to minimize the risk of missing rare, serious diagnoses when evaluating headache patients, the vast majority of which will be due to a benign etiology. One such tool is the SNNOOP10 criteria for red flags.<sup>10,11</sup>

#### SNNOOP10 Criteria:

- Systemic symptoms, including fever
- Neoplasm in history
- Neurologic deficit or dysfunction
- Onset of headache is sudden or abrupt
- Older age (greater than 65 years old)
- Pattern change or recent onset of headache
- Positional headache
- Precipitated by sneezing, coughing, or exercising
- Papilledema
- Progressive headache and atypical presentations
- Pregnancy or puerperium
- Painful eye with autonomic features
- Posttraumatic onset of headache
- Pathology of the immune system
- Painkiller overuse

Patients with one or more “positive” SNNOOP10 criteria generally warrant further evaluation—possibly with neuroimaging, which typically also necessitates ED referral. This patient presented with multiple red flag symptoms for headache, including neurologic deficits, sudden onset of headache, and recent onset/new type of headache, which was precipitated with exertion.<sup>11</sup>

CVT is a rare neurovascular disorder with a wide array of presentations, however, headache is the most common presenting feature<sup>1</sup> and is present in 89% of patients with CVT.<sup>12</sup> Other less common presentations include visual loss, papilledema, diplopia, aphasia, paresis, seizures, ocular chemosis, and cranial nerve palsies, particularly CNIII, IV, and/or VI. In fact, most patients with CVT present with a normal neurologic exam.<sup>1,12</sup>

Thunderclap headache, in particular, is characterized by a high-intensity headache of abrupt onset, according to the International Classification of Headache Disorders 3 (ICHD-3).<sup>13</sup> Abrupt onset likewise is defined as reaching maximum intensity in less than 1 minute.<sup>14</sup>

*“There are no routine laboratory tests that can confirm or exclude CVT.”*

While not the most common presentation, CVT has been associated with a “thunderclap” nature at onset and can also lead to new-onset focal deficits, as was seen with the patient presented.<sup>1,14,15,16</sup> Given the variable nature of CVT clinical presentations, it is common for the diagnosis to be incidentally discovered in an evaluation for other neurovascular conditions, namely SAH. In the International Study on Cerebral Vein and Dural Sinus Thrombosis (ISCVT), the median time from symptom onset to diagnosis was 7 days.<sup>12</sup>

The incidence of CVT is approximately 2 per 100,000 patients and occurs 3 times more frequently in females.<sup>17,18,19,20</sup> Common risk factors for CVT include hereditary thrombophilias (eg, factor V Leiden, protein S deficiency etc.), acquired thrombophilias (eg, pregnancy and the puerperal period), oral contraceptive use, obesity, malignancy, and head injury.<sup>3</sup> In children, the most common risk factors include head and neck infections such as otitis media, mastoiditis, and sinusitis and in older children and connective tissue disorders.<sup>4</sup> Unlike ischemic stroke, CVT is more common in individuals less than 50 years of age.<sup>5</sup> In the (ISCVT), thrombophilia and oral contraceptives were identified as the most common risk factors for CVT.<sup>12</sup> Additionally, in recent years, an association of CVT with both recent COVID-19 infection and/or recent receipt of adenovirus vector SARS-CoV-2 vaccination has been also been identified.<sup>21,22</sup>

#### Diagnosis

There are no routine laboratory tests that can confirm or exclude CVT. While d-dimer has been explored as a screening test for CVT, a d-dimer level below standard cutoffs used in algorithms for evaluating for VTE (ie, <500 µg/L) has been found to be insufficiently sensitive for clinical use in ruling out CVT, regardless of the pre-test probability.<sup>3,23,24</sup>

Imaging with a non-contrast head CT is not suffi-

ciently sensitive to exclude CVT.<sup>25</sup> Therefore, it is recommended to use CT venography or magnetic resonance venography.<sup>1</sup>

### Management and Outcomes

CVT is managed typically as an inpatient after initial diagnosis, as patients are at increased risk for elevated intracranial pressure, bleeding, and/or seizures, and benefit from close monitoring of their neurologic status. Patients are typically treated with heparin or other systemic anticoagulation at the time of diagnosis. Anticoagulation is often continued after hospitalization.<sup>1</sup> Mortality associated with CVT ranges from 8-10% and is increased in those who present with coma, hemorrhage, deep cerebral vein thrombosis and in those cases associated with infection or cancer.<sup>26</sup>

### Ethics Statement

Despite multiple attempts, the patient could not be contacted for follow-up. Therefore, demographic information and some case details were changed to protect patient confidentiality.

### Takeaway Points for Urgent Care Providers

- In addition to cervical artery dissection and intracranial hemorrhage/SAH, CVT should be included in the differential diagnosis for sudden onset or “thunderclap” headache.
- Headache is the most common associated symptom of CVT but is not universally present. Other symptoms of CVT may include seizure and focal neurologic deficits, however, most patients with CVT have an initially normal neurologic exam.
- Risk factors for CVT include female gender, younger age (<50 years), history of venous thromboembolism or thrombophilia, current or recent pregnancy, hormonal contraception, malignancy, recent COVID-19, and active head and neck infections.
- The SNNOOP10 list of red flag symptoms suggestive of higher risk for dangerous causes of headache is a valuable screening tool for UC clinicians to determine which patients with headache warrant ED referral and/or neuroimaging.
- A negative d-dimer is insufficiently sensitive to exclude CVT. The imaging study of choice for evaluating for CVT is either CT or MR venography. ■

Manuscript submitted January 21, 2024; accepted March 13, 2024.

### References

1. Ropper AH, Klein JP. Cerebral Venous Thrombosis. *New England Journal of Medicine*. 2021;385(1):59-64. doi:10.1056/NEJMr2106545
2. Dam LF van, Walderveen MAA van, Kroft LJM, et al. Current imaging modalities for diagnosing cerebral vein thrombosis – A critical review. *Thrombosis Research*. 2020;189:132-139. doi:10.1016/j.thromres.2020.03.011
3. Saposnik G, Barinagarrementeria F, Brown RD, et al. Diagnosis and management of cerebral venous thrombosis: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2011;42(4):1158-1192. doi:10.1161/STR.0b013e31820a8364
4. deVeber G, Andrew M, Adams C, et al. Cerebral sinovenous thrombosis in children. *N Engl J Med*. 2001;345(6):417-423. doi:10.1056/NEJM200108093450604
5. Konakondla S, Schirmer CM, Li F, Geng X, Ding Y. New Developments in the Pathophysiology, Workup, and Diagnosis of Dural Venous Sinus Thrombosis (DVST) and a Systematic Review of Endovascular Treatments. *Ageing Dis*. 2017;8(2):136-148. doi:10.14336/AD.2016.0915
6. Stovner L, Hagen K, Jensen R, et al. The global burden of headache: a documentation of headache prevalence and disability worldwide. *Cephalalgia*. 2007;27(3):193-210. doi:10.1111/j.1468-2982.2007.01288.x
7. Minen M, Zhou K, Lall R, Friedman BW. A Retrospective Cohort Study of Urgent Care Visits and Revisits for Headache/Migraine. *Pain Med*. 2020;21(10):2458-2464. doi:10.1093/pm/pnaa182
8. National Hospital Ambulatory Medical Care Survey: 2017 Emergency Department Summary Tables. Published online January 2020. [https://www.cdc.gov/nchs/data/nhamcs/web\\_tables/2017\\_ed\\_web\\_tables-508.pdf](https://www.cdc.gov/nchs/data/nhamcs/web_tables/2017_ed_web_tables-508.pdf)
9. Yang S, Orlova Y, Lipe A, et al. Trends in the Management of Headache Disorders in US Emergency Departments: Analysis of 2007–2018 National Hospital Ambulatory Medical Care Survey Data. *J Clin Med*. 2022;11(5):1401. doi:10.3390/jcm11051401
10. Do TP, Remmers A, Schytz HW, et al. Red and orange flags for secondary headaches in clinical practice. *Neurology*. 2019;92(3):134-144. doi:10.1212/WNL.0000000000006697
11. Hansen P. More than a simple headache: using the SNNOOP10 criteria to screen for life-threatening headache presentations. *J Urgent Care Med*. 2023;17(9):18-21
12. Ferro JM, Canhão P, Stam J, Boussier MG, Barinagarrementeria F, ISCVT Investigators. Prognosis of cerebral vein and dural sinus thrombosis: results of the International Study on Cerebral Vein and Dural Sinus Thrombosis (ISCVT). *Stroke*. 2004;35(3):664-670. doi:10.1161/01.STR.0000117571.76197.26
13. Headache Classification Committee of the International Headache Society (IHS). The International Classification of Headache Disorders, 3rd edition (ICHD-3). *Cephalalgia*. 2018;38(1):1-211.
14. Hainer BL, Matheson EM. Approach to Acute Headache in Adults. *AFP*. 2013;87(10):682-687.
15. Boussier MG, Chiras J, Bories J, Castaigne P. Cerebral venous thrombosis—a review of 38 cases. *Stroke*. 1985;16(2):199-213. doi:10.1161/01.str.16.2.199
16. Mortimer AM, Bradley MD, Stoodley NG, Renowden SA. Thunderclap headache: Diagnostic considerations and neuroimaging features. *Clinical Radiology*. 2013;68(3):e101-e113. doi:10.1016/j.crad.2012.08.032
17. Coutinho JM, Ferro JM, Canhão P, et al. Cerebral venous and sinus thrombosis in women. *Stroke*. 2009;40(7):2356-2361. doi:10.1161/STROKEAHA.108.543884
18. Coutinho JM, Zuurbier SM, Aramideh M, Stam J. The incidence of cerebral venous thrombosis: a cross-sectional study. *Stroke*. 2012;43(12):3375-3377. doi:10.1161/STROKEAHA.112.671453
19. Devasagayam S, Wyatt B, Leyden J, Kleinig T. Cerebral Venous Sinus Thrombosis Incidence Is Higher Than Previously Thought: A Retrospective Population-Based Study. *Stroke*. 2016;47(9):2180-2182. doi:10.1161/STROKEAHA.116.013617
20. Kristoffersen ES, Harper CE, Vetvik KG, Zarnovicky S, Hansen JM, Faiz KW. Incidence and Mortality of Cerebral Venous Thrombosis in a Norwegian Population. *Stroke*. 2020;51(10):3023-3029. doi:10.1161/STROKEAHA.120.030800
21. Liberman AL. Diagnosis and Treatment of Cerebral Venous Thrombosis. *Continuum (Minneapolis)*. 2023;29(2):519-539. doi:10.1212/CON.0000000000001211
22. Kim AY, Woo W, Yon DK, et al. Thrombosis patterns and clinical outcome of COVID-19 vaccine-induced immune thrombotic thrombocytopenia: A Systematic Review and Meta-Analysis [published correction appears in *Int J Infect Dis*. 2022 Oct;123:166]. *Int J Infect Dis*. 2022;119:130-139.
23. Heldner MR, Zuurbier SM, Li B, et al. Prediction of cerebral venous thrombosis with a new clinical score and D-dimer levels. *Neurology*. 2020;95(7):e898-e909
24. Smith E, Kumar V. BET 1: Does a normal D-dimer rule out cerebral venous sinus thrombosis (CVST)? *Emerg Med J*. 2018;35(6):396-397.
25. Linn J, et al. Noncontrast CT in deep cerebral venous thrombosis and sinus thrombosis: comparison of its diagnostic value for both entities. *AJNR Am J Neuroradiol*. 2009 Apr;30(4):728-35. doi: 10.3174/ajnr.A1451. Epub 2009 Feb 12. PMID: 19213820; PMCID: PMC7051779
26. Carletti F, Vilela P, Jäger HR. Imaging Approach to Venous Sinus Thrombosis. *Radiol Clin North Am*. 2023;61(3):501-519