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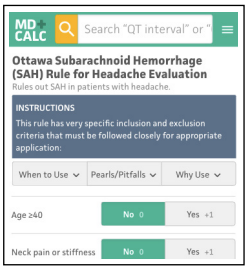

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Ottawa Subarachnoid Hemorrhage Rule

Introduction: The Ottawa subarachnoid hemorrhage rule is used to rule out subarachnoid hemorrhage in patients with headache.

Points & Pearls

- The Ottawa subarachnoid hemorrhage (SAH) rule was developed to be used in patients presenting to the emergency department (ED) with acute nontraumatic headache.
- The rule is 100% sensitive for SAH (ie, it is a rule-out tool).
- The rule should only be used in patients who are alert and oriented, are presenting within 14 days of the headache, and have no history of head trauma or a fall in the past 7 days.
- The Ottawa SAH rule cannot be used in patients who have new neurologic deficits, a previous history of headache syndrome, or intracranial lesions. **(See the Evidence Appraisal section for the complete list of exclusion criteria.)**
- The specificity of the Ottawa SAH rule is low (15%), so it should not be used to diagnose SAH, even in patients for whom all criteria are positive. Clinician judgment should be used to determine further workup, if any, for patients who fail the rule.

Advice

Consider workup for SAH in patients who have **any** positive criteria; however, given the low specificity of the rule, not every patient who fails the rule will require workup for SAH. In patients for whom all criteria are negative, consider avoiding further SAH-specific workup.

CALCULATOR REVIEW AUTHOR

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Critical Actions

Patients in whom SAH has been ruled out may still have other causes of headache that require workup or intervention. The differential diagnosis should be broad.

Evidence Appraisal

The first iteration of what is now known as the Ottawa SAH rule was derived by Perry et al in 2010. The study prospectively enrolled 1999 patients with headache who were from 5 Canadian tertiary care centers; 130 of these patients had confirmed SAH. Sixteen variables were identified as predictive for SAH (13 on history and 3 on physical examination). Recursive partitioning was used to identify combinations of these variables and create the 3 separate decision rules with the highest sensitivity for SAH.

Perry et al (2013) prospectively validated these findings in a study of 2131 patients at 10 sites, using the following inclusion and exclusion criteria for enrollment:

Inclusion criteria

- Glasgow coma scale score = 15 of 15 (ie, patient was alert and oriented)
- No history of fall or head trauma in the past 7 days
- Presentation within 14 days of headache onset

Exclusion criteria

- A previously established history of headache syndrome
- Referral from another institution with a confirmed diagnosis of SAH
- Returning for reassessment of a headache that was previously evaluated with computed tomography (CT) and lumbar puncture

- Presence of papilledema
- New focal neurologic deficits
- Previous diagnosis of a cerebral aneurysm, SAH, brain tumor, or hydrocephalus

The variables were again run through recursive partitioning and the final Ottawa SAH rule was found to be 100% sensitive for SAH (95% confidence interval [CI], 25.6%-29.5%). Specificity was 15.3% (95% CI, 13.8%-16.9%).

Not all patients in the validation study underwent a full workup with CT scan and lumbar puncture (80% had a CT scan and 45% had lumbar puncture). The patients who were discharged without undergoing a CT scan and lumbar puncture were assessed using a follow-up tool that included structured telephone interviews and medical records review. The authors acknowledged that some patients with small nonaneurysmal SAH may have been missed.

Bellolio et al (2015) also externally validated the Ottawa SAH rule by retrospectively applying it to 454 patients who presented to the ED with headache. Sensitivity was 100% (95% CI, 62.9%-100%) but specificity was lower than in the validation by Perry et al (7.6%, 95% CI 5.4%-10.6%), so the authors concluded that the rule's clinical use may be limited.

According to the hierarchy of evidence for clinical decision rules that was developed by McGinn et al (2000), the Ottawa SAH rule is a level 2 clinical decision rule, with established accuracy in at least 1 large prospective study, but no impact analysis completed as of yet.

Instructions

The Ottawa SAH rule has very specific inclusion and exclusion criteria that must be followed closely for appropriate application:

- **Only apply the rule** in alert patients aged ≥ 15 years who present with a new, severe nontraumatic headache that reaches maximum intensity within 1 hour.
- **Do not use the rule** in patients who have new neurologic deficits, prior aneurysm, prior SAH, known brain tumors, or chronic recurrent headaches (≥ 3 headaches of the same character and intensity occurring over a period of ≥ 6 months).

Why to Use

It is challenging to rule out SAH in patients who present with headache and no neurologic deficits. SAH is rare, accounting for approximately 1% of patients presenting to the ED with headache (Vermeulen 1990), but missed diagnoses ave potentially devastating results. A tool that reliably rules out SAH is useful to avoid unnecessary workups.

Lumbar puncture is often performed as the confirmatory test if a noncontrast head CT scan is negative but the clinical suspicion for SAH remains high. Lumbar puncture is painful and carries the risk of bleeding and of headache that may be worse than the original presenting headache.

When to Use

Use the Ottawa SAH rule in patients aged ≥ 15 years who present with headache and are neurologically intact.

Next Steps

In patients who have any positive criteria for the Ottawa SAH rule (ie, SAH cannot be ruled out), workup for SAH typically begins with a noncontrast head CT. Consider lumbar puncture and/or cerebral angiography if clinical suspicion remains. In their 2013 validation study, Perry et al provided insight into the appropriate workup for patients with possible SAH.

- A noncontrast head CT obtained within 6 hours of headache onset is sufficient to rule out SAH in most patients.
- Lumbar puncture should be performed for patients who are at particularly high risk for SAH.
  - » If there is no visual xanthochromia and the fourth tube of the lumbar puncture has a red blood cell count < 2000 x 10^6/L, SAH is ruled out except in patients at "ultra-high risk" (described in the study as patients with > 50% clinical pretest probability for SAH).
  - » If the patient is "ultra-high risk," CT angiography can be performed to evaluate for cerebral aneurysm. Neurosurgical consultation may be helpful in these patients.
- CT angiography can be useful if there was a significant time delay between the patient's presentation to the ED and the initial headache (eg, a headache that occurred last week).

Neurology and neurosurgical consultation should be obtained for patients with suspected or confirmed SAH.

Abbreviations: CT, computed tomography; ED, emergency department; SAH, subarachnoid hemorrhage.

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Calculator Creator

Jeffrey J. Perry, MD, MSc
Click here to read more about Dr. Perry.

References

Original/Primary Reference

- Perry JJ, Stiell IG, Sivilotti ML, et al. High risk clinical characteristics for subarachnoid haemorrhage in patients with acute headache: prospective cohort study. *BMJ.* 2010;341:c5204
  DOI: https://doi.org/10.1136/bmj.c5204

Validation References

- Perry JJ, Stiell IG, Sivilotti ML, et al. Clinical decision rules to rule out subarachnoid hemorrhage for acute headache. *JAMA.* 2013;310(12):1248-1255.
  DOI: https://doi.org/10.1001/jama.2013.278018
- Bellolio MF, Hess EP, Gilani WI, et al. External validation of the Ottawa subarachnoid hemorrhage clinical decision rule in patients with acute headache. *Am J Emerg Med.* 2015;33(2):244-249.
  DOI: https://doi.org/10.1016/j.ajem.2014.11.049

Additional References

- Vermeulen M, van Gijn J. The diagnosis of subarachnoid haemorrhage. *J Neurol Neurosurg Psychiatry.* 1990;53(5):365-372.
  https://www.ncbi.nlm.nih.gov/pubmed/2191083
- McGinn TG, Guyatt GH, et al. Users' guides to the medical literature: XXII: how to use articles about clinical decision rules. *JAMA.* 2000;284(1):79-84.
  DOI: https://doi.org/10.1001/jama.284.1.79
- Perry JJ, Alyahya B, Sivilotti ML, et al. Differentiation between traumatic tap and aneurysmal subarachnoid hemorrhage: prospective cohort study. *BMJ.* 2015;350:h568
  DOI: http://doi.org/10.1136/bmj.h568
- Perry JJ, Stiell IG, Sivilotti ML, et al. Sensitivity of computed tomography performed within six hours of onset of headache for diagnosis of subarachnoid haemorrhage: prospective cohort study. *BMJ.* 2011;343:d4277.
  DOI: http://doi.org/10.1136/bmj.d4277

Related Calculator
Hunt & Hess Classification of Subarachnoid Hemorrhage

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