

Do More Rules Make Us Safer? Clinical Decision Rules, Patient Safety, and the Role of Emergency Physicians in Health Care

Answers to the January 2014 Journal Club Questions

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Editor's Note: You are reading the 37th installment of Annals of Emergency Medicine Journal Club. This Journal Club refers the Perry et al¹ article titled "Clinical Decision Rules to Rule Out Subarachnoid Hemorrhage for Acute Headache" that was published in JAMA. Information about Journal Club can be found at <http://www.annemergmed.com/content/journalclub>. Readers should recognize that these are suggested answers. We hope they are accurate; we know that they are not comprehensive. There are many other points that could be made about these questions or about the article in general. Questions are rated "novice" (NOV), "intermediate" (INT), and "advanced" (ADV) so that individuals planning a journal club can assign the right question to the right student. The "novice" rating does not imply that a novice should be able to spontaneously answer the question. "Novice" means we expect that someone with little background should be able to do a bit of reading, formulate an answer, and teach the material to others. Intermediate and advanced questions also will likely require some reading and research, and that reading will be sufficiently difficult that some background in clinical epidemiology will be helpful in understanding the reading and concepts. We are interested in receiving feedback about this feature. Please e-mail journalclub@acep.org with your comments.

DISCUSSION POINTS

1. The authors state that "5.4% of confirmed subarachnoid hemorrhages were misdiagnosed during the patients' initial emergency department [ED] assessment."¹
 - (NOV) A. What source did the authors cite as the reference for this frequency of missed subarachnoid hemorrhage diagnoses? How does this source compare to other articles about the diagnosis of subarachnoid hemorrhage in terms of reported miss rate and study methodology? Does a subarachnoid hemorrhage misdiagnosis frequency of 1 in 20 seem reasonable in your ED? (For the purposes of this question, assume the same definition that the source authors use.) If not, what factors might decrease the number of missed subarachnoid hemorrhage diagnoses below that reported in the cited reference?
 - (INT) B. How might different stakeholders (eg, patients, physicians, administrators, insurers) choose to define a "missed" diagnosis? How does, and how should, the risk of morbidity associated with a miss affect this definition?
 - (NOV) C. What are the implications for the practice of emergency medicine, depending on whose definition we choose to operationalize? How might resource availability in a particular health care setting affect how a "miss" is defined?
2. In this article, 26% of patients arrived by ambulance, and "arrival by ambulance" was one of the 4 variables in rule 2. The inclusion of this variable suggests that patients arriving by ambulance are at greater risk for subarachnoid hemorrhage.
- (NOV) A. In some settings, patients arriving by ambulance are automatically triaged to higher-acuity beds. How might the patient's location in the ED when treated by the clinician affect the evaluation that he receives? How might the "assignment bias" that occurs when low-acuity patients arriving by ambulance are preferentially placed into evaluation rooms rather than directed to the waiting room or a lower-acuity treatment area affect ED throughput and staffing models? Why might this be especially important for EDs that employ midlevel providers or resident moonlighters to staff the low-acuity areas?
3. The specificity of the Ottawa Subarachnoid Hemorrhage Rule is such that nearly 85% of patients with potentially concerning headache would require computed tomography (CT) and lumbar puncture. The authors acknowledge that "[t]he Ottawa Subarachnoid Hemorrhage Rule does not lead to a reduction of testing (ie, CT, lumbar puncture, or both) vs current practice; however, it may help to standardize which patients with acute headache require investigations, and its widespread use could help decrease missed subarachnoid hemorrhages."¹
 - (INT) A. The present accepted standard for a subarachnoid hemorrhage evaluation includes a nonenhanced CT study and, if the CT result is negative, a lumbar puncture. Using the data provided in the article, calculate the percentage of the entire cohort who underwent this complete evaluation. Do this using the data in Figure 1 and then repeat the exercise using the data in the tables. Are the estimates concordant? Can you reconcile them? What is your best estimate of how many patients received a

complete evaluation by the physicians, and how does this compare with the 85% who would receive an evaluation under the Ottawa clinical decision rule?

- (NOV) B. What if the standard evaluation for subarachnoid hemorrhage was only a nonenhanced CT? How many patients had a brain CT in the ED? How does this percentage compare with the Ottawa rule's 85% testing rate? What is the incremental benefit of the Ottawa Subarachnoid Hemorrhage Rule over CT imaging alone?
- (INT) C. Focus on Table 4, which reports the characteristics of the 11 patients with a subarachnoid hemorrhage not identified by 1 or more of the clinical decision rules. How many of the patients who ultimately required a surgical intervention were "missed" and discharged from the ED? Does Table 4 inform the reader how many of these patients underwent CT and lumbar puncture in the ED? If the data are not available in the table, can you find these numbers elsewhere in the article?
- (INT) D. The final rule has a specificity of 15.3%, meaning that 5 of 6 patients would receive a CT/lumbar puncture evaluation. Is the rule going to benefit patients or harm them? Did the authors compare the decision rules' performance to the performance of the treating clinicians? If the investigation did not perform this comparison, opine why such a comparison was not conducted. Why is such a comparison critical to evaluating the impact of a decision rule?
- (INT) E. Consider which of the following outcomes, decreasing the frequency of missed subarachnoid hemorrhage diagnoses or reducing the use of tests (ie, CT, lumbar puncture, and angiography), might be more important to practicing clinicians. Which might be more important to hospital administrators adjusting to the reimbursement reductions that will accompany the full implementation of the Patient Protection and Affordable Care Act? What about public health administrators?
4. The initial study describes how classification and regression tree (CART) analysis was applied to a single data set to derive 3 4-element rules that seemed to have similar test characteristics.²
- (INT) A. Why would the investigators derive 3 different rules from the same data set? What does the ability to derive 3 similarly performing rules from the data set suggest about the nature of the clinical question? The utility of rules for that question? The process by which the rules were developed? What special considerations arise when age is used as one of the criteria?
- (INT) B. The authors then further refine the rules by augmenting one after they had seen the results of the validation study. Do you think that the new rule is valid or, because it was developed post hoc, does it need to be validated in an external data set? If it fails to validate, what would that imply about the process by which it was created?

ANSWER 1

Q1. The authors state that "5.4% of confirmed subarachnoid hemorrhages were misdiagnosed during the patients' initial emergency department [ED] assessment."¹

Q1.a What source did the authors cite as the reference for this frequency of missed subarachnoid hemorrhage diagnoses? How does this source compare to other articles about the diagnosis of subarachnoid hemorrhage in terms of reported miss rate and study methodology? Does a subarachnoid hemorrhage misdiagnosis frequency of 1 in 20 seem reasonable in your ED? (For the purposes of this question, assume the same definition that the source authors use.) If not, what factors might decrease the number of missed subarachnoid hemorrhage diagnoses below that reported in the cited reference?

The authors' reference is a 2007 retrospective review of patients admitted during a 2-year period to any hospital in Ontario, Canada, through an ED who were subsequently identified as having a subarachnoid hemorrhage through a search of discharge diagnoses through a province-wide administrative database.³ Patients were classified as having a missed diagnosis of subarachnoid hemorrhage if they had another ED visit within the previous 14 days and received an alternative ED main discharge diagnosis consistent with those previously described as misdiagnoses in other studies of missed subarachnoid hemorrhage patients. This study, which identified 81 of 1,603 patients (5.4%) with a missed subarachnoid hemorrhage, describes a substantially lower miss rate than previous studies that quote rates between 12% and 51%.⁴⁻¹⁶ However, many of these previous studies were single-site, retrospective chart reviews with study sizes ranging from 13 to 482 patients, which brings into question their external validity. In addition, many were conducted before 1990, when CT scanners were less ubiquitous and had lower resolution than current scanners. Because current-generation CT scanners are up to 92% sensitive for diagnosing subarachnoid hemorrhage, the age of these previous studies makes them less relevant to today's practice.¹⁷ Finally, many of the subjects missed in the previous studies were initially treated in a variety of health care settings, including primary care offices with a lower-acuity patient population, making physician misdiagnosis more likely. In the 2 previous studies that subanalyzed the group of patients who initially presented to EDs, the miss rate was 5.2% and 10%, respectively.^{10,12} Given the heterogeneity and lack of external validity of previous studies, it is difficult to compare the quoted 5.4% miss rate to previous estimates.

How the reader interprets an subarachnoid hemorrhage miss rate of 1 in 20 will likely depend on clinical and resource availability where they practice. In the United States, emergency medicine was first recognized as a board specialty in 1979, and now more than half of emergency physician demand is being met by those who are board certified.¹⁸ Emergency medicine residencies specifically train physicians to have a heightened awareness of high-morbidity, low-likelihood diagnoses such as subarachnoid hemorrhage. In other diagnoses, such as pulmonary

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