Prediction Model for Lyme Meningitis Validated

BY DOUG BRUNK

Clinical features that separate Lyme meningitis from other causes of aseptic meningitis in children include longer duration of headache, the presence of cranial nerve palsies, and cerebrospinal fluid mononuclear cell predominance, results from a single-center study in Rhode Island demonstrated.

Those are key findings from a validation study of a clinical prediction model developed in 2006 to help clinicians distinguish Lyme meningitis from other causes of aseptic meningitis in children. It marks the first time the model has been prospectively evaluated in children living in a Lyme-endemic region of the United States.

The study "validates what clinicians have thought with regard to Lyme disease, that is, we can use acute clinical presentations to help differentiate Lyme meningitis from other causes of aseptic meningitis," Dr. Sharon Nachman of the department of pediatrics at the State University of New York at Stony Brook wrote in a commentary about the work (Pediatrics 2009;123:1408).

The original prediction model applied in the analysis is a logistic-regression model that uses history, physical, and laboratory findings to predict Lyme meningitis (LM) in children; the model was developed by researchers led by Dr. Robert A. Avery of the department of pediatrics at Jefferson Medical College, Philadelphia (Pediatrics 2006;117:e1-7).

To prospectively validate this model, investigators led by Dr. Aris C. Garro of the division of pediatric emergency medicine at Rhode Island Hospital, Providence, studied 50 children aged 2-18 years who presented to Hasbro Children's Hospital in Providence with a lumbar puncture for meningitis that showed a cerebrospinal fluid white blood cell count of more than 8 cells/mcL.

Cases of definite LM were defined as cerebrospinal fluid pleocytosis with positive Lyme serology confirmed by immunoblot or erythema migrans rash. Cases of possible LM were defined as cerebrospinal fluid pleocytosis with positive cerebrospinal fluid Lyme antibody.

The researchers applied the original prediction model to their cohort. They also used 10% increments of calculated probability of LM to determine sensitivity, specificity, and likelihood ratios for definite and possible LM (Pediatrics 2009;123:e829-34).

The researchers found that certain probability percentage ranges could be used to categorize the children's risk of LM as low, intermediate, or high. For example, calculated probabilities of less than 10% resulted in a 100% negative predictive value (low risk, with a negative likelihood ratio of 0.006); calculated probabilities of 10%-50% placed patients into an intermediate-risk group; and calculated probabilities of greater than 50% placed patients into a high-risk group, with a positive likelihood ratio of 100.

Dr. Garro and his associates also discovered that if a child had less than 7 days of headache, less than 70% mononuclear cells, and no cranial nerve 7 palsy or other cranial neuropathy, the probability of LM was always less than 10%.

"We propose this 'Rule of 7's' as an easily remembered set of criteria that clinicians may be able to use to identify patients at low risk of LM," they wrote. "Future studies should evaluate this rule before it can be adopted into clinical practice."

The researchers acknowledged certain limitations of the study, including its small sample size and the fact that two-tier serum Lyme disease testing was not required for study entry, "allowing for possible misclassification of cases."

They concluded that the chief use of the clinical prediction model "is to limit unnecessary use of parenteral antibiotics in patients presenting with meningitis during peak enteroviral and [Lyme disease] seasons. Additional data from a larger, multicenter, prospective study in areas endemic for [Lyme disease] would provide additional validation for the use of this model in clinical practice."

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