

Translating Best Evidence into Best Care

Editor's Note: Journals reviewed for this issue: *Archives of Disease in Childhood*, *Archives of Pediatrics and Adolescent Medicine*, *British Medical Journal*, *Journal of the American Medical Association*, *Journal of Pediatrics*, *The Lancet*, *New England Journal of Medicine*, *Pediatric Infectious Diseases Journal*, and *Pediatrics*. Gurpreet K. Rana, BSc, MLIS, Taubman Medical Library, University of Michigan, contributed to the review and selection of this month's abstracts.

—John G. Frohna, MD, MPH

Pediatric cardiologists can accurately use physical examination to identify pathologic murmurs in neonates

Mackie AS, Jutras LC, Dancea AB, Rohlicek CV, Platt R, Beland MJ. Can cardiologists distinguish innocent from pathologic murmurs in neonates? *J Pediatr* 2009;154:50-4.

Question Among neonates with suspected congenital heart disease (CHD), how accurate is the clinical assessment as performed by pediatric cardiologists?

Design Prospective cohort.

Setting Montreal Children's Hospital, Canada.

Participants Neonates (n = 201, median age 12 days [range 2-31 days]) referred for outpatient evaluation of a heart murmur.

Intervention After a clinical evaluation, the cardiologist documented whether the murmur was "likely innocent" or "likely pathologic." The cardiologist repeated his/her assessment after electrocardiography was performed.

Outcomes Sensitivity and specificity of cardiologist evaluation, with echocardiography used as the gold standard.

Main Results The prevalence of CHD in this population was 56% (113 of 201). Clinical assessment alone identified patients with CHD with a sensitivity of 80.5% (95% CI, 73.2-87.8), specificity of 90.9% (95% CI, 84.9-96.9), positive likelihood ratio of 8.8 (95% CI, 4.8-28.3), and negative likelihood ratio of 0.21 (95% CI, 0.13-0.32). The addition of an electrocardiogram did not improve these test characteristics. Features that were predictive of CHD were murmur quality ($P < .0001$), location ($P = .02$), and timing ($P = .04$). No patients requiring catheter or surgical intervention were missed by clinical assessment.

Conclusions The prevalence of CHD in this referral population was high. Clinical assessment detected all complex CHD, although some simple lesions were missed. Murmur quality, location, and timing were predictive of CHD.

Commentary Given the current economic climate and the emphasis placed by the Obama administration on reform of the United States health care system on the basis of reigning in costs, this study is timely. Ninety-one of the 113 infants with CHD were accurately identified. Of the 22 false-negative results, 15 were believed to have peripheral pulmonic stenosis (PPS), and only 7 were classified as innocent murmurs. None of the misdiagnosed patients had significant lesions that would require early intervention. Only 8 of the 201 infants evaluated were thought to have CHD where none existed. Interestingly, the years of physician practice did not impact

diagnostic accuracy, nor did having an ECG before the examination. This study extends previous published observations to a group of particularly difficult patients. The neonatal cardiac examination is often quite challenging because of heart and respiratory rate, movement, and the soft quality of many murmurs. The data presented here underscore the value of having an exam performed by a trained subspecialist, particularly when the murmur is present in an otherwise healthy-appearing neonate, before obtaining expensive diagnostic testing. On the basis of the confidence of the practitioner in their assessment, one could also argue that conservative observation without performing an echocardiogram would be an appropriate course of action in several cases. In an era of increasing focus on cost containment, the role of the subspecialist remains very important in reducing unnecessary expensive testing. This role is even more relevant when considering the increasing complexity of pediatrics and the reduction of the time a general pediatrician spends learning basic cardiology skills during their training.

J. Carter Ralphe, MD

University of Wisconsin
American Family Children's Hospital
Madison, Wisconsin

Elbow extension test is helpful in decreasing the likelihood of an elbow fracture in children

Appelboam A, Reuben AD, Bengler JR, Beech F, Dutson J, Haig S, et al. Elbow extension test to rule out elbow fracture: multicentre, prospective validation and observational study of diagnostic accuracy in adults and children. *BMJ* 2008;337:2428-32.

Question In patients presenting with an elbow injury, does the elbow extension test accurately rule out bony injury?

Design Adults: multicenter prospective interventional validation study. Children: multicenter prospective observational study.

Setting Five emergency departments in southwest England.

Participants A total of 2127 adults and children admitted to the emergency department with acute elbow injury.

Intervention Elbow extension testing during routine care by clinical staff to determine the need for radiography in adults and to guide follow-up in children.

Outcomes Presence of elbow fracture on radiograph or recovery with no indication for further review at 7 to 10 days.

Main Results Of 1740 eligible participants, 602 patients were able to fully extend their elbow; 17 of these patients had a fracture. Two adult patients with olecranon fractures needed a change in treatment. In the 1138 patients without full elbow extension, 521 fractures were identified. Overall, the test had sensitivity of 96.8% (95% confidence interval 95.0 to 98.2) and specificity of 48.5% (95% CI, 45.6 to 51.4). Full elbow extension had a negative predictive value for fracture of 98.4% (96.3 to 99.5) in adults and 95.8% (92.6 to 97.8) in children. Negative likelihood ratios were 0.03 (0.01 to 0.08) in adults and 0.11 (0.06 to 0.19) in children.

Conclusions The elbow extension test can be used in routine practice to inform clinical decision making. Patients who cannot fully extend their elbow after injury should be referred for radiography, because they have a nearly 50% chance of fracture. For those able to fully extend their elbow, radiography can be deferred if the practitioner is confident that an olecranon fracture (for adults) or a supracondylar fracture (for children) is not present. Patients who do not undergo radiography should return if symptoms have not resolved within 7 to 10 days.

Commentary Clinical decision rules may help physicians practice cost-effective medicine, but unless the rules perform to an acceptable standard, the best we can hope for as clinicians are validated diagnostic tests. This is exactly how the “elbow extension test” should be viewed. Using clinically sound methods, Appleboam et al evaluate the performance of the test in a large number of children across a wide age range, representative of the typical practice in which such a test might be useful. For most physicians, though, including the authors, the sensitivity of 94.6% in children is not high enough to feel comfortable that a fracture has been “ruled out,” especially when considering the potential adverse outcomes of a missed supracondylar humerus fracture; by comparison, the Ottawa Ankle rules carry a pooled sensitivity of 98.5% in children.¹ On the other hand, the clinician’s toolbox now contains a validated clinical test for the pediatric elbow exam. Once other tests are developed and validated, the combination of multiple tests might result in an acceptable sensitivity to feel comfortable forgoing imaging. Alternatively, the combination of validated clinical and radiographic findings, such as the posterior fat pad sign,² might be useful in determining the likelihood of an occult fracture, thus avoiding overtreatment and unnecessary advanced imaging. For now, the elbow extension test should be used as a tool, not a rule.

Blaise A. Nemeth, MD, MS
University of Wisconsin
American Family Children’s Hospital
Madison, Wisconsin

References

1. Dowling S, Spooner CH, Liang Y, Dryden DM, Friesen C, Klassen TP, et al. Accuracy of Ottawa Ankle Rules to exclude fractures of the ankle

and midfoot in children: a meta-analysis. *Acad Emerg Med* 2009; epub ahead of print.

2. Skaggs DL, Mirzayan R. The posterior fat pad sign in association with occult fracture of the elbow in children. *J Bone Joint Surg Am* 1999;81: 1429-33.

Universal primer polymerase chain reaction can diagnose neonatal sepsis when performed before starting antibiotics

Dutta S, Narang A, Chakraborty A, Ray P. Diagnosis of neonatal sepsis using universal primer polymerase chain reaction before and after starting antibiotic drug therapy. *Arch Pediatr Adolesc Med* 2009;163:6-11.

Question Among neonates with suspected sepsis, how accurate is a universal primer 16S rRNA gene polymerase chain reaction (PCR) for diagnosis of blood culture–positive neonatal sepsis before and after starting antibiotic drug therapy?

Design Prospective study of diagnostic tests.

Setting Level III neonatal intensive care unit.

Participants Neonates with a fresh episode of clinically suspected sepsis were enrolled; those with major malformations, life expectancy less than 12 hours, or contaminated blood cultures were excluded.

Intervention Before starting antibiotic drug therapy, PCR (0 hour), blood culture, and sepsis screening (complete blood cell counts, micro-erythrocyte sedimentation rate, and C-reactive protein level) were performed. The PCR was repeated 12, 24, and 48 hours after starting antibiotic drug therapy.

Outcomes The primary outcomes were the sensitivity and specificity of 0-hour PCR for diagnosing blood culture-positive sepsis, and the secondary outcome was the proportion of 0-hour PCR-positive patients who remained positive after antibiotic drug therapy.

Main Results Of 306 patients evaluated, 242 were included (mean [SD] gestation, 32.2 [3.1] weeks; and mean [SD] birth weight, 1529.2 [597.2] g). Blood culture was positive in 52 patients and 0-hour PCR in 57. The sensitivity, specificity, positive and negative predictive values, and positive and negative likelihood ratios of PCR were 96.2%, 96.3%, 87.7%, 98.8%, 26.1, and 0.04, respectively. Two patients were blood culture positive but 0-hour PCR negative, whereas 7 were 0-hour PCR positive but blood culture negative. Of the patients in the 0-hour PCR-positive group, 7 remained positive at 12 hours and none at 24 and 48 hours after starting antibiotic drug therapy. In patients in the 0-hour PCR-positive group, no predictors of positive 12-hour PCR were identified.

Conclusions Universal primer PCR can accurately diagnose neonatal sepsis before, but not after, antibiotic drugs are given.

Commentary Blood culture remains an imperfect test for prompt and accurate diagnosis of neonatal sepsis. Universal PCR does not depend on bacterial viability, so the authors hypothesized it could identify sepsis in patients exposed to antibiotics with killed bacterial fragments present, but in whom blood culture results could be false negative. The study