Perspective

Evidence-Based Medicine in the EMR Era

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Many physicians take great pride in the practice of evidence-based medicine. Modern medical education emphasizes the value of the randomized, controlled trial, and we learn early on not to rely on anecdotal evidence. But the application of such superior evidence, however admirable the ambition, can be constrained by trials' strict inclusion and exclusion criteria — or the complete absence of a relevant trial. For those of us practicing pediatric medicine, this reality is all too familiar. In such situations, we are used to relying on evidence at Levels III through V — expert opinion — or resorting to anecdotal evidence. What should we do, though, when there aren't even meager data available and we don't have a single anecdote on which to draw?

We recently found ourselves in such a situation as we admitted to our service a 13-year-old girl with systemic lupus erythematosus (SLE). Our patient's presentation was complicated by nephrotic-range proteinuria, antiphospholipid antibodies, and pancreatitis. Although anticoagulation is not standard practice for children with SLE even when they're critically ill, these additional factors put our patient at potential risk for thrombosis, and we considered anticoagulation. However, we were unable to find studies pertaining to anticoagulation in our patient's situation and were therefore reluctant to pursue that course, given the risk of bleeding. A survey of our pediatric rheumatology colleagues — a review of our collective Level V evidence, so to speak — was equally fruitless and failed to produce a consensus.

Without clear evidence to guide us and needing to make a decision swiftly, we turned to a new approach, using the data captured in our institution's electronic medical record (EMR) and an innovative research data warehouse. The platform, called the Stanford Translational Research Integrated Database Environment (STRIDE), acquires and stores all patient data contained in the EMR at our hospital and provides immediate advanced text searching capability.[1] Through STRIDE, we could rapidly review data on an SLE cohort that included pediatric patients with SLE cared for by clinicians in our division between October 2004 and July 2009. This "electronic cohort" was originally created for use in studying complications associated with pediatric SLE and exists under a protocol approved by our institutional review board.

Of the 98 patients in our pediatric lupus cohort, 10 patients developed thrombosis, documented in the EMR, while they were acutely ill. The prevalence was higher among patients who had persis-

Results of Electronic Search of Patient Medical Records (for a cohort of 98 Pediatric Patients with Lupus) Focused on Risk Factors for Thrombosis Relevant to Our 13-Year-Old Patient with Systemic Lupus Erythematosus.*			
Outcome or Risk Factor	Keywords Used to Conduct Expedited Electronic Search	Prevalence of Thrombosis	Relative Risk (95% CI)
		no./total no (%)	
Outcome — thrombosis	"Thrombus," "Thrombosis," "Blood clot"	10/98 (10)	Not applicable
Thrombosis risk factor			
Heavy proteinuria (>2.5 g per deciliter)			
Present at any time	"Nephrosis," "Nephrotic," "Proteinuria"	8/36 (22)	7.8 (1.7–50)
Present >60 days	"Urine protein"	7/23 (30)	14.7 (3.3–96)
Pancreatitis	"Pancreatitis," "Lipase"	5/8 (63)	11.8 (3.8–27)
Antiphospholipid antibodies	"Aspirin"	6/51 (12)	1.0 (0.3–3.7)

* In all cases, the sentences surrounding the keywords were manually reviewed to determine their relevance to our patient. Pancreatitis was defined as an elevated lipase level (twice the upper limit of normal) coexisting with abdominal pain. We used the word "aspirin" as a proxy for antiphospholipid antibodies, since it is standard practice at our institution to give all patients with these antibodies aspirin; if "aspirin" was found in the chart, than antiphospholipid-antibody status was confirmed by investigating the laboratory results.

tent nephrotic-range proteinuria and pancreatitis (see table). As compared with our patients with lupus who did not have these risk factors, the risk of thrombosis was 14.7 (95% confidence interval [CI], 3.3 to 96) among patients with persistent nephrosis and 11.8 (95% CI, 3.8 to 27) among those with pancreatitis. This automated cohort review was conducted in less than 4 hours by a single clinician. On the basis of this real-time, informatics-enabled data analysis, we made the decision to give our patient anticoagulants within 24 hours after admission.

Our case is but one example of a situation in which the existing literature is insufficient to guide the clinical care of a patient. But it illustrates a novel process that is likely to become much more standard with the widespread adoption of EMRs and more sophisticated informatics tools. Although many other groups have highlighted the secondary use of EMR data for clinical research,[2,3] we have now seen how the same approach can be used to guide real-time clinical decisions. The rapid electronic chart review and analysis were not only feasible, but also more helpful and accurate than physician recollection and pooled colleague opinion. Such real-time availability of data to guide decision making has already transformed other industries,[4] and the growing prevalence of EMRs along with the development of sophisticated tools for real-time analysis of deidentified data sets will no doubt advance the use of this data-driven approach to health care delivery. We look forward to a future in which health information systems help physicians learn from every patient at every visit and close the feedback loop for clinical decision making in real time.

Did we make the correct decision for our patient? Thrombosis did not develop, and the patient did not have any sequelae related to her anticoagulation; truthfully, though, we may never really know. We will, however, know that we made the decision on the basis of the best data available — acting, as the fictional detective Nero Wolfe would say, "in the light of experience as guided by intelligence."[5] In the practice of medicine, one can't do better than that.

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