Febrile Infants: Aligning Science, Guidelines, and Cost Reduction With Quality of Individualized Care

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ABBREVIATIONS

CBC—complete blood cell count
EB-CPM—evidence based care process model
PROS—Pediatric Research in Office Settings
SBI—serious bacterial illness
WBC—white blood cell count

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In the decade since Ken Roberts wrote about an ending to the 30-year febrile infant odyssey,1 the quest for optimal management continues. A recent evidence report by the Agency for Healthcare Research and Quality leaves the question unanswered,2 and an American Academy of Pediatrics subcommittee is actively addressing this issue. The study by Byington et al3 in this issue of Pediatrics makes several important contributions. This study confirms the incidence of the most serious bacterial illnesses (SBIs), meningitis (0.3%) and bacteremia (2.0%).3 These findings are consistent with the large community-based study by the Pediatric Research in Office Settings (PROS) network (0.5% and 1.8%, respectively)4 and those from large emergency department and network studies (bacterial meningitis: 0.3%–0.7%; bacteremia: 1.9%–2.2%).5 6 The infrequent occurrence makes this condition best-studied in large integrated systems or in collaborative research networks. However, the number of large studies is limited, and only PROS included a national community-based sample. The carefully developed evidence-based care process model (EB-CPM) used in the study by Byington et al3 was based on extensive research. The entry point for the study was “well appearance.” Studies on the ability to judge clinical appearance are limited, but there is agreement, even by residents, on what constitutes “well appearing.”7 “Ill appearance” is 1 of the best predictors of serious illness4,8,9; we expect that appreciating different nuances in ill appearance improves with experience. A complete blood cell count (CBC) and urinalysis are to be performed on all infants. It will be argued whether this is equally important for a 7-day-old and an 87-day-old, for an uncircumcised versus circumcised male. Furthermore, although a white blood cell count (CBC) and urinalysis are to be performed on all infants. It will be argued whether this is equally important for a 7-day-old and an 87-day-old, for an uncircumcised versus circumcised male. Furthermore, although a white blood cell count (WBC) is an independent predictor of SBI, it added only slightly to diagnostic accuracy beyond a history and examination in the PROS study. An analysis of bacteremia/bacterial meningitis for 1746 febrile infants excluding WBC, the area under the receiver operating characteristic curve was 0.77; by adding abnormal WBC, the area under the receiver operating characteristic curve increased to 0.80.4 Recursive partitioning analysis, clinical appearance, age, and height of fever were used to identify a low-risk group in which only 4 of 1056 febrile infants had underlying bacteremia/meningitis; an abnormal WBC did not add to the ability to identify those at low risk.4 Furthermore, a CBC is often accompanied by simultaneously requesting a blood culture. A recent study of 4255 blood cultures in infants revealed that 73% of positive culture results were contaminants,10 potentially leading to increased treatments, iatrogenic complications, and costs. Although a WBC can sometimes help in decision-making, it is important to be aware of its actual value and costs. The EB-CPM was effective in significantly improving antibiotic usage and identifying more infants with urinary tract infections. Another major accomplishment discussed by Byington et al was reducing costs due to earlier discharge and discontinuation of antibiotics.3
These savings more than offset the increased labortatory costs. However, outside of an integrated system, this may create savings to insurers while helping budgets in some segments of the health care system and hurting others. Nevertheless, being discharged 6 hours earlier is unquestionably a benefit for parents and reduces exposures to nosocomial infections and iatrogenic complications.

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The methods of quality improvement in this study add to the literature as a model for transforming the process of care. Not only was there an increase in clinicians adhering to the EB-CPM, but there was a decrease in site variability. Parents deserve a system in which their infants will receive comparable quality of care whether they are seen on the north or south side of town. One previous study indicated that the major variability in physician approach to febrile infants is the child’s clinical appearance. Although this study makes important contributions, questions about optimal management remain. Recent research questions the need for a lumbar puncture on all children receiving antibiotics (for urinary tract infections). Furthermore, the recommended viral testing is unavailable even in many academic centers. Adopting this model nationally would increase costs due to additional laboratory testing and hospitalizations. In the study implementation period, 80% had a CBC drawn compared with 42% in the PROS study; the cpm calls for a complete sepsis workup and hospitalizing all infants <28 days, whereas PROS practitioners did this for only 46% of infants. Yet, the results were comparable for “miss rate of bacteremia/meningitis.” For the EB-CPM at Intermountain Healthcare, 1 case of meningitis was not detected among 67 cases of bacteremia/bacterial meningitis. In the PROS study, 1 case of meningitis and 1 of bacteremia among 65 cases were not initially treated; both had recoveries without sequelae. So what is a practitioner to do? It is likely that experienced clinicians will continue to rely on clinical judgment. Whereas most strategies classify infants by using 3 or 4 variables, practitioners have additional historical information and far more variables to input that both increase (abnormal cry) and decrease (URI, bronchiolitis, family illness) the likelihood of an SBI. Illness is a dynamic process, and unlike emergency department situations, primary care physicians have the opportunity to monitor progress by calling a parent before a 24-hour return visit. Practitioners’ clinical judgments will be aided in the future by collaborative pooling of data from large studies/data sets and by using recursive partitioning analysis and other statistical methods to determine a precise risk for each infant. Consequently, clinical judgment will be enhanced with an individualized, evidence-based guideline developed for each infant. Perhaps then, the odyssey will end.

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