

## Electronic fetal monitoring: does it really lead to better outcomes?

Lawrence D. Devoe, MD

As an obstetrician, present at the dawn of intrapartum electronic fetal monitoring (EFM), I had every expectation that EFM would improve perinatal outcomes and that these effects would be validated by robust clinical trials. However, metaanalysis of the randomized controlled trials (RCTs) comparing EFM with fetal heart tone auscultation failed to show that EFM decreases the most adverse perinatal events, mortality and hypoxic neurologic injury.<sup>1</sup> Whether taken individually or collectively, the published trials were simply not adequately powered for these tragic outcomes which, fortunately, are quite rare. Consequently, 4 decades after its introduction into intrapartum care, the benefits, if any, that may be attributable to EFM remain to be conclusively established.

This current situation makes the study by Chen et al<sup>2</sup> potentially quite important. First, its sheer size far exceeds the preceding RCTs in aggregate. Second, unlike the earlier RCTs, this study *did* find that EFM use was associated with significantly reduced rates of neonatal mortality and low Apgar scores. Third, the improved survivorship of preterm fetuses receiving EFM is noteworthy because most of the previous trials focused on term or near term infants. Fourth, fewer neonatal seizures were observed in the “high-risk” group who received EFM. Finally, like the previous RCTs, EFM was associated with increased rates of operative vaginal deliveries, and cesarean section for “fetal distress.”

The authors opine that these encouraging results reflect the ability of EFM to provide “accurate and early detection of fetal acidemia” and to encourage appropriate interventions. As a retrospective cohort study rather than a prospective clinical usage trial, a *post hoc, propter hoc* relationship between the use of EFM and the neonatal outcomes observed cannot be absolutely determined. One could also argue that Apgar scores and/or neonatal seizures may not be adequate surrogate markers for hypoxic neurologic injury, because they can stem from numerous causes other than intrapartum oxygen deprivation. Further, birth certificates as data sources have some significant limitations. Unlike complete medical records, they do not af-

ford a glimpse into the actual fetal heart rate (FHR) tracings to determine whether they were properly interpreted or acted on. Other possibly relevant and important details of medical care and decision making that might have affected neonatal outcomes were not available to the investigators.

From another perspective, it may be important to note that the period of this study antedates the recent recommendations for FHR terminology and interpretation made by an expert panel assembled in 2008 by the National Institute of Child Health and Human Development (NICHD). These proceedings resulted in a 3-tier classification system, described in the recent American College of Obstetrics and Gynecology Practice Bulletin.<sup>3</sup> It is probable that the preceding 2-tier classification system, otherwise known as “reassuring” or “nonreassuring,” was the one considered by those who cared for patients in this study population. As a member of the first NICHD expert panel on FHR pattern terminology, I still believe that FHR pattern categorization was well intended. However, as underscored in an opinion paper by Parer and King,<sup>4</sup> even 3 tiers might be insufficient to provide adequate delineation of fetal risk. More to the point, validation of the benefits of using this 3-tier classification system or its preceding 2-tier counterpart has yet to be realized by adequately powered clinical trials.

However, the issues surrounding EFM, past and present, may not really be about FHR pattern categories at all. Consider the numerous trials that have shown relatively poor reliability and reproducibility of visual EFM interpretation.<sup>5</sup> Should we finally concede that eyes and brains differ on the significance of squiggles on monitor displays and strip chart recorders and that this situation may never be fully reconciled for observers with differing training backgrounds and experience? Would computer-assisted interpretation of FHR patterns improve the reliability and effectiveness of EFM, reduce preventable mortality and morbidity, and decrease unnecessary interventions and could *this* hypothesis be tested in an RCT? The technology to achieve these goals has been available for some time and some of it is embedded in the alerting systems of current day fetal monitors.<sup>6</sup> Given the encouraging results of this study, this might be *the* very time to get the proverbial ball rolling in *that* direction.

Recognition of the limitations of unaided visual interpretation of EFM has also stimulated development and application of other adjunctive screening technologies, such as fetal scalp blood pH, fetal pulse oximetry, and, more recently, fetal ECG ST-segment analysis. Of these, only fetal ECG ST-segment analysis<sup>7</sup> remains a viable option in the United States and is undergoing rigorous evaluation by the Maternal Fetal Medicine Unit Network in a nascent multicenter randomized trial. Time will tell if, in the United States, this adjunctive method-

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From the Section of Maternal-Fetal Medicine, Department of Obstetrics and Gynecology, School of Medicine, Georgia Health Sciences University, Augusta, GA.

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Dr Devoe is a consultant for Neoventa Medical (Mölnådal, Sweden) maker of the STAN fetal ECG ST-segment monitor.

0002-9378/free

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doi: 10.1016/j.ajog.2011.04.023

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ology will improve the specificity of visual FHR pattern interpretation as well as perinatal outcomes and appropriateness of obstetric interventions as it has in other countries.<sup>7</sup>

Returning to the central question implicit in this study, should every parturient, regardless of risk status, and with a pregnancy of any viable gestational age, receive continuous EFM? Chen et al<sup>2</sup> do not have the definitive answer and neither do I. Given the enormity of undertaking the adequately powered RCT that should be done when EFM was introduced, it is unlikely that the desired level I evidence will be available any time soon. Even if such a study were considered, that is, comparing EFM with fetal heart tone auscultation, would there be sufficient bed side work force to make it feasible? Lacking this study, and if we *provisionally* accept the hypothesis that EFM *does* improve perinatal outcomes, then the obvious corollary is to address the more frequent, possibly excessive number of obstetric interventions that accompany EFM and place many mothers at risk. Whether such interventions can be made more appropriately by making our fetal monitors more “intelligent” or by using well-studied adjunctive screening methods, or both, it behooves all who care for laboring patients to encourage work on this side of the equation as the overwhelming

majority of laboring patients will continue to receive EFM, beneficial or not, in the foreseeable future. ■

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