
MONITORING THE FETUS IN LABOR: EVIDENCE TO SUPPORT THE METHODS

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ABSTRACT

Electronic fetal monitoring (EFM) was implemented across the United States in the 1970s. By 1998, it was used in 84% of all U.S. births, regardless of whether the primary caregiver was a physician or a midwife. Numerous randomized trials have agreed that continuous EFM in labor increases the operative delivery rate, without clear benefit to the baby. Intermittent auscultation (IA) is safe and effective in low-risk pregnancies and may play a role in helping birth remain normal. Clinicians and educators are encouraged to reconsider the use of IA in the care of healthy childbearing women. *J Midwifery Womens Health* 2001;46:366–373 © 2001 by the American College of Nurse-Midwives.

Since the 1970s, 99% of U.S. births each year have occurred in hospital settings (1). Within hospitals, the use of electronic fetal monitoring (EFM) to assess fetal well-being in labor has become essentially universal. This is now true regardless of whether the primary care provider is a physician or a midwife (2). The high prevalence of EFM use runs counter to the available evidence on methods of monitoring the fetus in labor and has redefined the character of the institutional childbirth experience. This article reviews the development and adoption of EFM in labor and discusses the state of the scientific evidence on methods of monitoring the fetus in labor.

DEVELOPMENT OF EFM

For two centuries, the presence of fetal heart tones, as well as notations of the rate and rhythm, have been recognized as indicators of fetal well-being (3,4). The presence of regular heart tones has confirmed fetal life, and a fast, slow, or irregular rate has been viewed as a source of concern. Methods of listening similar to the fetal stethoscope (fetoscope or Pinard-type stethoscope) amplified fetal sounds by bridging contact between the maternal abdomen and the listener's external ear. For approximately 150 years, the definition of "normal" has been recognized as a regular fetal heart rate in the range of 120–160 beats per minute. "Fetal distress" has been defined as persistent tachycardia (above 160), persistent

bradycardia (below 100–120), irregularities of the fetal heart rate, or the presence of meconium-stained amniotic fluid (3), definitions that are still used today. With the advent of EFM, other fetal heart patterns have been added to the list as possible indicators of fetal distress.

Continuous EFM was developed in the 1960s by researchers working simultaneously in the United States, Germany, and Uruguay (5). EFM was developed as a screening test for intrapartum asphyxia. The goal of continuous observation of the fetal heart rate was to identify "abnormal" fetal heart patterns so that timely intervention (expedited birth) might lower rates of perinatal morbidity and mortality resulting from asphyxia. Researchers assumed that neurologic insults resulted from intrapartum asphyxia and that specific EFM patterns would be correlated with fetal hypoxia (low oxygen levels) and subsequent asphyxia (tissue damage from hypoxia and metabolic acidosis).

The early work on EFM patterns defined periodic decelerations of the fetal heart baseline and noted that late decelerations and severe variable decelerations were more likely than other patterns to be associated with pH reductions in fetal scalp blood samples (6). Early observational studies suggested that the use of continuous EFM might lower intrapartum death rates (7,8). Even though observational studies can overestimate the benefit of a treatment or intervention (9), great enthusiasm for this hopeful technology resulted, leading to dissemination of the technique before data were available from randomized trials.

GROWTH OF EFM USE IN THE UNITED STATES

Continuous EFM in labor was implemented in the 1970s across the United States. By 1980, it was used in 45% of all U.S. births (10). A steady increase followed, with EFM used in 62% of all U.S. births in 1988 (10), 76% of births in 1991 (11), and 84% of births in 1998 (1). Through the 1980s, the rise in use of EFM was greater in low-risk women than in women with risk indicators (10). The current rate of 84% (1998 is the most recent year for which complete data for the nation are available) may represent a nearly universal adoption of EFM in labor, because some women who give birth do not labor (eg, elective cesareans), and some arrive at the labor unit in

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very advanced labor, ready to deliver and, therefore, have no opportunity for continuous EFM to be used in their care. In addition, 1% of women each year deliver at home or in freestanding birth centers where intermittent auscultation is used (1).

RANDOMIZED TRIALS: EFM VERSUS IA

A meta-analysis of randomized trials comparing continuous EFM with intermittent auscultation (IA) can be found in the Cochrane Library (12). This informational and statistical synthesis combines the results of nine randomized clinical trials, conducted in the United States, Europe, and Australia. In these studies, individual women were randomly assigned to either continuous EFM or IA for fetal surveillance in labor, and maternal and fetal/neonatal outcomes were subsequently measured. This meta-analysis includes data for over 18,000 women, 13,000 of whom were from a single study (the Dublin, Ireland trial). All of the other studies had between 200 and 1400 participants.

The studies compared continuous EFM with IA. EFM was by the internal method (fetal scalp electrode) in most of the trials; the women generally labored in bed, and the monitor strip was assessed every 15 minutes in the first stage of labor and every 5 minutes in the second stage. In most of the included studies, IA was defined as counting the fetal heart rate every 15 minutes in the first stage of labor, and in the second stage, every 5 minutes or with each uterine contraction. Listening would continue for a full minute, beginning near the end of a contraction (determined by palpation of the maternal abdomen), and a fetoscope or handheld doppler would be used to count the heart rate. The Dublin study and four others included fetal scalp blood sampling to measure fetal acidosis and verify abnormal fetal heart patterns. Four of the smaller studies included high-risk as well as low-risk women, and one study enrolled only women having preterm labor.

Results of the meta-analysis showed that an increased rate of operative delivery is associated with continuous EFM use, particularly in low-risk women. Overall, based on the included studies, the risk of a cesarean was increased by 40% with routine EFM use, and the risk of a vaginal operative birth by 20%. No differences were seen in rates of low Apgar scores, admissions to a neonatal intensive care unit (NICU), stillbirths, or early neonatal deaths according to the method of monitoring

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the fetus. EFM use was associated with a reduction of early neonatal seizures, but long-term follow-up showed no differences by study group (EFM versus IA), so the clinical significance of this finding is not clear.

Three studies make unique contributions to the Cochrane review and are briefly highlighted. The first is the study from Dublin, Ireland (13). This is the largest randomized trial in perinatal medicine to date, with 12,964 women enrolled. Caregivers performed amniotomies at hospital admission, and some women were not admitted to the study: those with meconium-stained amniotic fluid, oligohydramnios, abnormal fetal heart rate patterns, or who delivered within an hour of hospital admission. In this trial, each laboring woman had a personal midwife or student midwife as a bedside caregiver. EFM was by the direct method using a fetal scalp electrode. IA was accomplished with a Pinard stethoscope or a handheld doppler, and the listening frequency was every 15 minutes in the first stage of labor, and with each contraction in the second stage. Scalp blood sampling was used to verify abnormal fetal heart data from both the EFM and IA groups. The cesarean rates were 2.4% in the EFM group and 2.2% in the IA group, a nonsignificant difference. *This extremely low rate of cesareans would influence overall conclusions about cesarean delivery in a meta-analysis where the Dublin data contribute the majority of women.* Vaginal operative deliveries were 8.2% in the EFM group and 6.3% in the IA group, which was statistically significant.

Many neonatal outcomes were examined in the Dublin study and found to be the same for the EFM and IA groups: low Apgar scores, resuscitations, NICU admissions, neonatal infections, trauma, and intrapartum and neonatal deaths. Seizures within the first 48 hours were the only notable difference: 12 infants from the EFM group (6,474 women) and 27 infants from the IA group (6,490 women). Closer inspection revealed the excess in the IA group to be partially explained by longer labors augmented with oxytocin. In this particular clinical setting, oxytocin augmentation began at 6 mU per minute and was increased by 6 mU every 15 minutes until a maximum of 40 mU per minute was reached. Thus, it is possible that IA used with this style of labor augmentation was inadequate fetal surveillance to prevent seizures.

Follow-up of infants in the Dublin trial to age 4 to assess neurologic status revealed cerebral palsy in 12 children in the original EFM group and 10 in the original IA group (14). Of children who had manifested early neonatal seizures, only three children per group (EFM or IA) had persistent neurologic abnormalities. So the type of fetal assessment, EFM or IA, is probably not associated with greater or lesser long-term neurologic morbidity. Early neonatal seizures are a very rare event, occurring at a rate of approximately 3 per 1,000 (13). Of the nine trials included in the Cochrane review, only the

Dublin study included enough women to consider such a rare outcome.

One study in the Cochrane review enrolled women having preterm births (15). The authors were interested in whether continuous EFM would improve outcomes for these vulnerable infants, because eight prior studies had not shown any clear long-term advantages for full-term infants. Women in labor at 26–32 weeks were, therefore, assigned to continuous EFM (122 women) or IA (124 women) in a multicenter trial. All women had 1:1 bedside nursing care, and scalp blood sampling was used to verify abnormal EFM data. IA was performed every 15 minutes in the first stage of labor and at least every 5 minutes in the second stage. The fetal heart baseline was obtained between contractions, and, when listening, the 30 seconds immediately after a contraction was used to classify the fetal heart rate as reassuring, non-reassuring, or ominous. The cesarean rates were 16% with EFM and 15% with IA, with fetal distress being the most common reason.

The preterm infants were evaluated at 4, 8, and 18 months to assess developmental and neurologic status. The EFM group showed a higher rate of cerebral palsy at 18 months (20% compared to 8% of infants in the IA group) and worse developmental outcomes. This large difference may have been related to the slower response time by clinicians to fetal heart abnormalities (median of 104 minutes in the EFM group and 60 minutes in the IA group). However, this finding is puzzling given that both groups had 1:1 bedside nursing and the cesarean rates were equivalent.

Only one study in the Cochrane review found a lower perinatal mortality associated with continuous EFM use. The study from Athens, Greece (16) has been criticized for methodologic problems, such as randomization by flip of a coin, very uneven group sizes (746 to EFM and 682 to IA), failure to include consecutive patients, and inadequate statistical power to assess perinatal mortality as an endpoint (17,18). Women with gestations of 26 weeks or more were assigned to either EFM or IA as the only method of fetal surveillance. Scalp blood sampling was not used, and crossovers were not permitted (eg, instituting continuous EFM for fetal heart abnormalities identified by IA). Total operative deliveries were 23% (EFM) versus 18% (IA).

No significant differences were found for any infant morbidity measure: low Apgar scores, resuscitations, NICU admissions, assisted ventilation, seizures, or length of hospital stay. However, two perinatal deaths occurred in the EFM group and nine in the IA group. Of the two deaths in the EFM group, one was due to a congenital anomaly and one followed oral trauma with an intubation attempt. In the IA group, four deaths occurred after assisted vaginal deliveries, two occurred in extremely premature infants, and one infant had a con-

genital anomaly, leaving two unexplained. The group differences in perinatal mortality are hard to interpret, given the methodologic problems of this study, the higher baseline rate of perinatal mortality in Greece, and the curious finding of no differences in *any* perinatal morbidity measure, which would be expected to occur far more frequently than perinatal death.

OTHER RESEARCH

Three other important studies that address the effectiveness of EFM as a fetal surveillance method must be mentioned. The first is from Parkland Hospital in Dallas, Texas (19). This study is not included in the Cochrane review, because technically, it is not a randomized clinical trial where each woman is assigned to a study group by a random process. In addition, the study did not directly compare EFM with IA. This prospective cohort study was conducted in a 3-year period by using an alternate-month design to compare universal with selective EFM. Every other month, 19 fetal monitors were available for staff to use in a 20-bed labor unit, and in the months in between, only seven machines were available. When the number of machines was limited, staff were forced to make choices about which patients most needed continuous electronic surveillance in labor. In this study, listening intervals for IA (in the selective EFM months) were every 30 minutes, and the nurse/patient ratio for all patients during the 3-year study period was 1:2.

The Parkland Hospital study included 17,571 women in the selective EFM group and 17,759 women in the universal EFM group, nearly twice the total number of women in the Cochrane review. The distributions of demographic characteristics and obstetric complications in the two groups were virtually identical. Some 37% of all women had continuous EFM during the “selective” months, compared with 79% in the “universal” months. Indications for using continuous EFM in the selective months were as follows: oxytocin administration, dysfunctional labor, fetal heart rate abnormalities, meconium, maternal medical problems, twins, breech, post-dates, and preterm labor. Universal EFM was associated with a small but significant rise in cesarean births (totals of 19% for universal EFM versus 17.2% in the selective monitoring group), but all measures of perinatal morbidity and mortality were equal in the two groups (including seizures and perinatal deaths).

The second study is a population-based study in California (20) that examined the association of cerebral palsy (CP) with specific fetal heart patterns during labor in infants who weighed 2,500 g or more at birth. A case-control design was used where cases were defined as all singleton children born in a 3-year period in four California counties and who were diagnosed with CP soon after birth ($N = 95$). The randomly chosen controls

were similar in all ways except for no neonatal diagnosis of CP ($N = 378$). Birth records were obtained from hospital charts to compare labor events, including fetal heart patterns and their assessment by caregivers. Multiple late decelerations and decreased variability were associated with an increased risk of cerebral palsy. However, many children without neurologic impairment had also demonstrated these patterns. The false-positive rate of EFM was calculated for the population ($N = 155,636$) at more than 99%; thus, using specific EFM patterns to guide intervention will usually be wrong.

The third study is a recent clinical trial from the United Kingdom comparing techniques for fetal heart assessment at labor admission. Outcomes of the 20-minute admission recording were compared in 1,736 low-risk women at term who were assigned to either continuous EFM or assessment using a handheld doppler (21). Women in the EFM group were more likely to receive continuous EFM during labor, and they received more obstetric procedures (artificial rupture of membranes, labor augmentation, and epidurals) and operative births. No differences in any neonatal variables were observed. Thus, EFM did not predict or improve neonatal outcomes.

This very large body of research (randomized trials and other studies, more than 5,000 labors studied) shows that EFM and IA are equally effective as methods of intrapartum fetal surveillance in low-risk childbearing women, when assessments are conducted every 15 minutes in the first stage of labor and at least every 5 minutes in the second stage. In other words, continuous EFM offers no apparent advantage, even when used at the hospital admission evaluation. As suggested by the Dallas study, less frequent listening intervals for IA may be reasonable, but, thus far, no data from randomized trials are available on this point. EFM also has a very high false-positive rate, so abnormal patterns frequently will not mean that a problem is occurring, and intervention for all presumed abnormalities will result in overtreatment. It is possible that continuous EFM may be a preferable surveillance method for preterm or high-risk labors (where the fetus may have greater vulnerability to hypoxia), but the available data for these groups are, thus far, inconclusive. The bottom line is: in low-risk women, continuous EFM is associated with an elevated risk of operative birth, but neither EFM or IA offers distinct advantages for the fetus or neonate in averting significant health problems.

EFM AS A SCREENING TEST

EFM was developed as a screening test for perinatal asphyxia. A screening test should be able to separate those who might have a problem from those who do not

have a problem (22). Persons identified as potentially having a problem can then receive further diagnostic testing and appropriate therapeutic interventions. A screening test is judged by how well it fulfills four criteria (22):

1. Validity: accurate detection of the condition of interest
2. Reliability: agreement among those who interpret the data
3. Sensitivity: few false negatives
4. Specificity: few false positives

Although EFM has good sensitivity, performance on the other criteria is poor. If only one of four criteria is met, EFM cannot be considered an effective screening method for perinatal asphyxia.

Validity

The meaning of EFM abnormalities and whether they reflect current or prior events are matters of controversy. The epidemiologic evidence suggests that intrapartum asphyxia is more likely caused by prenatal factors (genetics, exposures, and infections) than by events during labor (23–25). As such, abnormal EFM patterns noted in labor may indicate prior fetal damage, which leaves the fetus unable to tolerate labor. This idea provided the original rationale for the 20-minute admission EFM strip (26): to identify a subgroup of compromised fetuses at labor onset who may benefit from more intensive monitoring during labor. The cause-and-effect relationships of abnormal fetal heart patterns to perinatal asphyxia and, in turn, to brain damage are not clear, unidirectional, or unequivocal. Markers of asphyxia (low Apgar scores, fetal blood acidosis, neonatal seizures, or abnormal EFM patterns) are poorly correlated with each other, and all are poorly correlated with subsequent neurologic damage (24).

Fetal heart patterns that accurately predict significant asphyxia have not been specified. The best candidates (repetitive late decelerations, severe variable decelerations, and persistent bradycardia, with absent variability) do not apply in all cases (20,25–28). The absence of variability can be due to factors other than hypoxia: prematurity, fetal sleep, narcotics, and congenital malformations (26). Term babies are often relatively resistant to hypoxic insults because of the presence of fetal hemoglobin, and because of the capacity to deliver excess oxygen to their own tissues (28); thus, even severe hypoxia may have no noticeable effect on many term babies. Treatment options for asphyxia are limited, and common interventions (operative delivery methods) can themselves be asphyxiating events. Cerebral palsy is rare, and its main risk factors are preterm birth and low birth weight (29). The population rate of CP at 2 per

1,000 has not changed for decades and has been unaffected by the rise in cesarean births for presumed fetal distress as identified by EFM. It is not surprising that the potential for a nonspecific screening method (EFM) to reduce CP would, therefore, be negligible when the causal connections are so unclear.

Reliability

EFM interpretation continues to suffer from lack of agreement among those who read and interpret EFM strips. Studies have repeatedly found that “experts” often disagree about which patterns are present on EFM strips, what the patterns mean, and the appropriate clinical actions to take (24–27). Experts even disagree with themselves when presented with the same strips at a later date (30). The availability of a lengthy written record of fetal heart activity in labor may actually increase medicolegal jeopardy for caregivers when expert witnesses can easily disagree about what is on a strip and what it means (31).

Consensus exists for two EFM patterns (late decelerations and severe variable decelerations) with regard to recognition, their underlying pathophysiology, and appropriate clinical responses (25,26). These patterns can be identified with intermittent auscultation. A workshop sponsored by the National Institute of Child Health and Human Development (NICHD) has attempted to address the reliability problem by developing standardized terminology for visual identification of EFM patterns (28). Whether the report will influence practicing clinicians, particularly those who work outside of teaching hospitals, is not known.

Sensitivity

Only 50% of all labors will show a completely “normal” fetal heart tracing throughout the course of labor (27). A high degree of consensus exists on the definition of a normal EFM strip: baseline of 110–160, regular rate, presence of accelerations, presence of variability, and absence of periodic decelerations (27,28). These EFM data are strongly correlated with a healthy, well-oxygenated fetus, and favorable neonatal outcomes. Thus, false negatives are very few, and sensitivity for EFM is high.

Specificity

The other half of all fetuses may show one or more deviations from the normal pattern during labor; these may be transient, intermittent, or persistent. The meaning of most of these patterns is not known; however, what is known is that most variations do not indicate a serious problem. A high false-positive rate results from many EFM patterns being classified as a problem, when a

problem is not truly present. In recent years, this has resulted in operative births for presumed fetal distress, particularly when no backup method is used to verify the EFM data. Atypical EFM findings should alert clinicians to pay close attention and gather more data. Because healthy fetuses can show a great variety of heart rate patterns, all EFM data must be interpreted in context. Gestational age, uterine contraction pattern, maternal medical condition, and current medication use (including narcotics for labor pain) are important parameters to consider when interpreting EFM strips.

Because EFM is a screening procedure, verification of worrisome findings is important. The NICHD workshop did not address backup methods to verify presumed abnormalities on EFM strips (28). Methods that have been used to avoid overreaction and overtreatment of EFM variations include fetal scalp blood sampling, vigorous scalp stimulation, and vibroacoustic stimulation (5). Fetal scalp blood sampling was used in most of the randomized trials comparing EFM with IA. Fetal heart accelerations from arousal due to scalp stimulation or vibroacoustic stimulation compare favorably with scalp blood samples that indicate a non-acidotic fetus (5,27,32). Fetal pulse oximetry is now under investigation to determine whether it is a useful adjunct to continuous EFM. This technique requires a padlike sensor to be inserted through the cervix and lodged between the fetal face and the uterine wall to measure fetal oxygen saturation. Normal values lie in the range of 30–70%.

In a multicenter randomized trial, 1,010 women with abnormal EFM patterns were randomly assigned to continuous EFM (usual care) versus EFM with fetal pulse oximetry (33). Cesarean rates in the oximetry group were halved for fetal distress but doubled for dystocia; thus, no overall reduction in cesarean was seen. All neonatal outcomes were equal in the two groups. In this study, 95% of all women received an epidural, and only 50% had spontaneous births. Increased accuracy in the diagnosis of fetal distress did not translate into improvements in maternal or infant well-being.

CLINICAL ISSUES WITH EFM

No one disputes that monitoring the fetus in labor is a prime responsibility of clinicians. However, the important question is *by which method?* Using continuous EFM for essentially all low-risk women has dramatically altered the character of hospital-based childbirth. It has redefined a peak life event as an intensive care equivalent, where the main role of clinicians is to gather and interpret data, and continuous information about the fetus is assumed to be superior for clinical decision making.

The central role of technology has distanced caregivers from the bedside and reduced the amount of support-

ive care that women receive in labor. Routine use of continuous EFM has magnified the perceptions of clinicians about the presumed needs of the fetus and minimized the importance of the known needs of the mother. This is a problem because continuous support in labor is appreciated by women and has numerous benefits for new mothers. An assessment of women's views of monitoring methods was made in three of the clinical trials in the Cochrane review on EFM versus IA (34). Low-risk women were more positive about IA because of the additional support in labor, and the method of monitoring the fetus was less important to them than the level of support they received from staff. Clearly, women desire intensive support during labor.

A meta-analysis in the Cochrane Library has summarized data on social support in labor from 14 randomized trials involving more than 5,000 women in 10 countries (35). The data consistently show that social support reduces prolonged labors, operative births, low Apgar scores, and need of medications for pain relief. Support is associated with decreases in breastfeeding failure, postpartum depression, and mothering difficulties. Because emotional support tempers the maternal stress ("fight or flight") response in labor, the intrauterine environment may be improved for the fetus, thus lowering the risk of fetal distress. As such, labor support may actually be a primary prevention modality. For low-risk women, social support in labor is the single most effective care measure that clinicians can render (36).

Routine EFM use commonly dictates bed rest in labor. This limits other care options (eg, ambulation and use of baths or showers for pain relief) that cause no harm, are low-cost, and are self-regulated. Social support in labor, intermittent auscultation, mobility and position change, and nonpharmacologic methods of pain relief are important to "keep birth normal" (36). These care measures occur in the context of physical presence and emotional support by the care provider. They reinforce the normalcy of childbirth and the importance of the woman's active involvement in her own care.

Since 1989, authoritative bodies in the United States have issued recommendations on fetal heart assessment in labor. The American College of Obstetricians and Gynecologists (ACOG) has indicated that either continuous EFM or IA is acceptable for women of all risk categories and recommends 1:1 nursing care, using listening/observation intervals of 15 minutes in the first stage of labor and 5 minutes in the second stage (37,38). The United States Public Health Service (USPHS) made the identical recommendation for low-risk pregnancies but advised continuous EFM for women with risk factors in their first report (39). Their update declared that insufficient data exist to make a firm recommendation of EFM over IA for high-risk women (40). Both ACOG (38) and the Association of Women's Health, Obstetric,

and Neonatal Nurses (41) have stated that listening intervals of 30 minutes in the first stage and 15 minutes in the second stage of labor *may* be appropriate for low-risk women. However, no data from clinical trials support this practice, so clinicians should view it with caution.

Despite the recommendations of ACOG and USPHS, and the huge body of evidence showing equal efficacy for IA with a lowered risk of operative birth, clinicians are almost exclusively using continuous EFM. Barriers to clinicians using IA for intrapartum fetal surveillance include lack of education, lack of exposure to IA in the clinical setting, lack of comfort with interval information, litigation worries, and too few hospital staff to provide 1:1 care. Current students of nursing, midwifery, and obstetrics receive little education about intermittent auscultation, compared with EFM, and have little exposure to clinical teachers who routinely use IA. In addition, clinicians-in-training have few opportunities to practice IA during clinical rotations. Experienced clinicians may have little faith in IA, assuming that continuous fetal heart data are somehow superior to interval information, although the available data do not show this to be true.

Some clinicians are afraid to rely on IA because of concerns about legal liability. The rationale for this concern is unclear, because authoritative bodies have declared either method (EFM or IA) to be acceptable, and an enormous body of research has shown equal effectiveness for the two methods of fetal surveillance. In addition, the continued lack of agreement with EFM strip interpretation may actually work against clinicians in the courtroom (31).

Assuring healthy birth outcomes requires frequent and regular assessments of mother and fetus throughout labor and initiation of appropriate clinical actions when deviations from normal occur. These goals can easily be met in the context of 1:1 care but are harder to achieve with higher patient/staff ratios, common in many institutions today. EFM has come to replace bedside care in many labor units and is a poor substitute. Even if strips are evaluated at 15- or 5-minute intervals (first and second stages, respectively), women do not receive the same level of interaction, support, and touch from their care providers and face a higher risk of operative birth as well.

Continuous EFM has been widely incorporated into the care of laboring women by physicians and also by hospital-based midwives (2); yet, no clear evidence indicates that its use with low-risk women has improved the health of either mothers or babies. This state of affairs poses a particular dilemma for the midwifery profession whose core values include the therapeutic value of human presence, the use of technology only when appropriate, and nonintervention in a normal process.

Firm evidence of the efficacy of continuous EFM in

high-risk pregnancies is not yet available, but a theoretical argument can be made so that it may be advantageous with more vulnerable fetuses. Results of the largest studies from Dublin and Dallas would support restricting EFM use to specific groups of women. Those with abnormal or nonphysiologic labors (mothers receiving oxytocin or dysfunctional labors) or where the fetus is at higher risk for hypoxia in labor (preterm, postdates, abnormal fetal heart tones, meconium, significant maternal health problems) may potentially benefit from continuous electronic fetal surveillance. But when continuous EFM is used, evaluation of the strip and patient every 15 minutes in the first stage of labor and every 5 minutes in labor is the research-based standard and is not different from the evaluation intervals with IA.

All childbirth practitioners, but especially midwives, need to consider reincorporating intermittent auscultation in the care of low-risk women. Low census days on labor units may permit 1:1 care and provide an opportunity to begin. Changes within education programs (classroom and clinical teaching), support for practicing clinicians, and revision of clinical practice policies that do not reflect current research or recommendations of key professional organizations may also be required to bring practice in line with evidence from research.

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