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The Electronic Fetal Monitor: Should Every Mother Have One?

SUMMARY

In little more than a decade, the use of electronic fetal monitoring has become standard obstetric practice. Increasingly it is being suggested that all labors should be monitored electronically, and that such universal monitoring will result in improved neonatal outcome. This paper reviews the evidence in what has been termed "the fetal monitoring debate",[1] concluding that there is no indication for monitoring low risk labors, and that in fact too many—rather than too few—labors are being monitored. (Can Fam Physician 1981; 27:1023-1028).

SOMMAIRE

Il a suffi d'un peu plus de dix années pour voir le moniteur couramment utilisé en obstétrique. On suggère de plus en plus d'avoir un moniteur pour le travail de chaque femme qui accouche. On pense que cet emploi généralisé améliorera la morbidité. Cet article passe en revue les témoignages dans ce qui a été appelé "le débat autour du moniteur" pour en venir à la conclusion que le moniteur n'est pas nécessaire dans les grossesses "à faibles risques". En fait, le moniteur est plutôt trop répandu que pas assez.

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MAYOR OF GENEVA[2] is credited with the first report, in 1818, of the presence of fetal heart tones. They were independently discovered and extensively publicized by a French nobleman, Lejumeau Vicomte de Kergaradec, in 1821. Legend suggests that the former made his discovery while applying his ear to the abdomen of a woman to hear the fetus move, and the latter—a pupil of Laennec—by attempting to hear, with Laennec's stethoscope, a fetus splash in its amniotic fluid.

Within 12 years of Kergaradec's description, Kennedy of Dublin published a monograph on fetal auscultation which included an accurate clinical account of intrapartum fetal distress. By the end of the 19th century the concept of fetal distress was firmly established, and in 1893 Winkel proposed a set of criteria for diagnosing distress which included, in addition to signs relating to the movement of the fetus and the passage of meconium, auscultatory standards—fetal tachycardia (heart rate above 160 bpm), bradycardia (heart rate below 100 bpm) and irregularity of the fetal heart.

These auscultatory criteria remained unchallenged until 1959 when Walker[3] reported on a relatively large controlled study, that operative interference for fetal distress did not improve the neonate's chances. He suggested that the contemporary clinical criteria for diagnosing intrapartum distress were probably inadequate.

Ten years later auscultatory standards were again questioned, this time in the U.S.A. Benson et al,[4] after reviewing some 25,000 deliveries in which the fetal heart rate was measured by specially trained observers every 15 minutes during the first stage of labor, and every five minutes in the second stage, concluded that ". . . there is no single reliable indicator of the fetus in trouble in terms of the FHR, save in the extreme . . . even a generally acceptable definition of fetal distress based upon the FHR is yet to be achieved".

By the end of the 1960s, the technique of electronic fetal monitoring (EFM) was gaining increasing attention. This was partly as a result of the aforementioned studies, but also reflected a growing obstetric concern with the condition of the fetus at a time when maternal mortality and morbidity rates were falling dramatically. The hope was that continuous monitoring, which provided additional data in both quality and quantity, would prove a more reliable predictor of fetal distress.

In the span of little more than a decade EFM has developed from an esoteric research tool into an apparently indispensable part of modern obstetric care. For example, it is used in 60-70% of all labors in the U.S.A., at a cost to that country estimated in one report at $411 million per year.[5]

For some, however, 60-70% is not good enough: "In today's modern obstetrical care, continuous intrapartum electronic monitoring of the fetal heart rate has reached a reliable and practical stage which makes it now feasible to monitor the FHR throughout labor

and delivery. All the available data support the value of FHR monitoring because it provides predictable, dependable, and reproducible information about the condition of the fetus. New categories of FHR patterns are being defined and learned. We have come to the conclusion that, in a sense, labor makes all babies high risk, and we ought to aspire to universal FHR monitoring in order to provide a safer transition for the fetus to the outside world."[6]

Such a point of view is no longer unusual in the obstetric world, yet has profound implications for the conduct of 'normal' as opposed to 'high risk' deliveries, at a time when there is an increasingly vocal lobby from mothers who are looking for a birth experience that is safe yet also satisfying.

Obstetricians advocate universal monitoring, while women look for a return to traditional values and family-centred care which, superficially at least, seems incompatible with silicon chips and light emitting diodes.

The family physician, as usual, is caught in the middle between the conflicting demands and standards of the medical profession in general and the patient in particular.

Should all mothers be monitored? The answer to that question seems to depend on the answers to three others:

1. Is the fetal heart rate, as measured by electronic monitors, an accurate predictor of fetal distress?
2. Does electronic fetal monitoring result in an improved outcome when compared with traditional auscultatory methods?
3. Are there any untoward side effects that may make electronic fetal monitoring undesirable?

Accurate Measure?

The measure of a diagnostic test is:

1. Its ability to detect disease if present—a quality referred to as 'sensitivity',
2. Its ability to identify correctly the absence of disease—a quality referred to as 'specificity'.

Under ideal circumstances the test should generate neither false predictions of abnormality (false positives), nor false predictions of normality (false negatives). Once the sensitivity and specificity of a test are known (these indexes remain stable) then predictive values for the test may be calculated for any given population. The predictive values of a test can change quite markedly when the prevalence of the disease in question changes. The effect of the prevalence of a disease on the usefulness of a test is important in the present context, and will be referred to later.

To derive values for its sensitivity and specificity, the test must be measured against a 'gold standard'—an accepted measure of normality/abnormality. The FHR has usually been measured against two gold standards—the Apgar score or the pH of the baby at birth. The Apgar score is the most often used standard. While it is a rather subjective measure of the infant's wellbeing in contrast to the pH value of the blood (a measure which is less open to observer bias), it is commonly used in clinical practice and is the basis on which clinical decisions are made.

It should be possible, from reports on the usefulness of a diagnostic test, to ascertain quickly how it performed against the gold standard.

The Department of Clinical Epidemiology and Biostatistics at McMaster University has recently published a series of papers giving advice on "How to Read a Clinical Journal", and offering standards by which scientific reports can be assessed. In the paper[7] which refers to articles about diagnostic tests, the authors suggest that, "The most straightforward method of displaying the comparison of a diagnostic test and a gold standard is with a 'two by two' or 'four fold' table. . . . The key words in such comparisons are 'sensitivity', 'specificity' and 'predictive value'. If you don't see at least the first two words in the abstract, beware. If you don't find or cannot construct a fourfold table from a sneak preview of the results section it's probably not worth your time to read any further; toss the article out and go onto the next one."

Had I followed this advice my task, and the length of this article, would both have been considerably shorter. The information on usefulness of EFM as a diagnostic test is generally hard to find, hard to read, and hard to assess. Most of the papers quoted as the basis for the diagnostic accuracy of EFM would not stand up to the scrutiny suggested above. Given these provisos, read on!

How does the FHR measure up as a diagnostic test? Not very well, according to Banta and Thacker:[5] "Using Apgar score to measure outcome, EFM is not a precise measure of fetal distress".

They summarized the data from five studies reporting on the diagnostic precision of electronic fetal heart rate measurements, and found that the percentage of false negatives (normal trace but a low Apgar score) ranged from seven percent to 20%, while the percentage of false positives (abnormal trace but a high Apgar score) varied from a low of 18.5% to a high of almost 80%.

Thus for example Beard et al,[8] in 1971, reported on the diagnostic accuracy of the FHR in 279 high risk patients when compared with neonatal Apgar and pH scores. The false positive rate in this study was 43.6% and the false negative rate 19.9%. The authors concluded that, "The interpretation of the abnormal FHR trace remains a major difficulty . . . although FHR traces are valuable in the assessment of the condition of the fetus they cannot be relied upon entirely . . . if continuous monitoring of FHR is used on its own in clinical practice a number of false positive diagnoses of fetal asphyxia are likely to be made".

In 1972, Schifrin and Dame[9] used continuous monitoring to predict the one minute Apgar score in 307 neonates. They found that they were able to predict Apgar scores greater than seven with 93% accuracy, but were accurate only 42.9% of the time when they tried to predict an Apgar score less than seven. They concluded that the major value of FHR monitoring lay in the prediction of the apparently normal neonate.

Gabert and Stenchever[10] monitored 749 labors. They claimed to have monitored both high and low risk labors but since their prevalence of fetal distress was approximately 32%, this claim must be suspect. They correctly predicted a good outcome (Apgar above six) 91.4% of the time, but were able to predict a poor outcome only 66% of the time. Thus 34% of the predictions of poor outcome were 'false positives', with the baby being normal at birth.

Shenker[11] fared even worse. In a survey of 1,000 labors he managed to predict a normal outcome (Apgar greater than six) 87.1% of the time, but could only predict correctly an abnormal outcome 31.8% of the time. He commented, "The present study confirms previous work which attests

to the accuracy of prediction of the newborn born in good condition". That was the good news. The bad news was: "Of high risk patients, 56% with late decelerations will be born in good condition. It should be apparent that electronic fetal heart rate monitoring cannot be used as the sole guide for management of labor in the face of an abnormal pattern. . . . Electronic fetal heart rate monitoring is unreliable in the prediction of babies born in poor condition. It does, however, provide an excellent screening test for selection of patients for scalp pH determination".

Beard[8] had arrived at the same conclusion. "In practical terms an abnormal FHR trace should be regarded as a warning sign indicating the need to check the fetal pH."

Unfortunately, even the fetal scalp pH gives false negatives (normal pH, low Apgar) ranging from 10-25% and false positives (abnormal pH, normal Apgar) ranging from 20-50% in different studies.[5]

Even used together the tests may still be imprecise. Beard[8] examined 68 babies with Apgar scores below seven at birth; only 22 of the 68 were abnormal on both tests and 17 of these had normal Apgar scores. Therefore even when combined, the tests still produced 44% false positives and 19% false negatives.[5]

Banta and Thacker,[5] reviewing the subject, conclude that, "In summary, results reported from leading medical centres largely using Apgar scores as the ultimate measure of the health status of the infant show that both fetal heart rate recording and fetal scalp blood pH sampling, used separately and together, have elevated rates of false positives and false negatives even in the most skilled hands".

Most studies of the FHR's diagnostic accuracy were conducted in high risk populations where fetal distress and poor condition at birth was a relatively common event. The fact that prediction on the basis of the FHR is correct at best only some 50% of the time when the prevalence of the disease is high is depressing enough. However, it also means that the performance of the test in a general population when fetal distress is relatively uncommon will be even worse, with a very poor ability to predict abnormal outcomes and with a high proportion of false positive results.

Using the results from the two largest studies quoted,[10, 11] and with some fancy fingerwork on a pocket calculator, it is possible to predict how the FHR would shape up as a diagnostic test for more 'normal' obstetric populations, and to demonstrate how the prevalence of a disease affects the predictive value and usefulness of a test—a point referred to earlier.

The prevalence of fetal distress was 32% in the Gabert study,[10] and 17.1% in the Shenker study.[11] Assume that the prevalence of fetal distress in a normal, low risk population is five percent, which is probably on the high side.

Using Gabert's data it is possible to calculate the positive predictive value of the FHR in his series, i.e. the percentage of positive tests that actually correlated with a poor outcome. With a 32% prevalence of distress, the positive predictive value of the test was 66%. Thus in 66% of cases the test accurately predicted a poor outcome. In our theoretical low risk population, the positive predictive value falls to 17.7%; thus, over 82% of the predictions of abnormality would be wrong.

In Shenker's study, with a 17.1% prevalence of fetal distress, the positive predictive value of the FHR was 31.8%, and thus the test incorrectly predicted a poor outcome almost 70% of the time. When the data from this study are applied to a low risk population, the positive predictive value falls to 10.7%—thus some 90% of the predictions of abnormality will be incorrect.

Nochinson and Cetrulo,[6] as quoted earlier, may consider that, "All the available data support the value of FHR monitoring because it provides predictable, dependable, and reproducible information about the condition of the fetus", but the evidence does not appear to support such a position.

A Task Force of The National Institute of Child Health and Human Development[12] recently examined the role of EFM as a diagnostic tool and concluded, "Fetal distress in labor cannot be assessed by considering a single measurement such as intermittent or continuous fetal heart rate. Because fetal heart rate patterns suggestive of hypoxia may occur in the absence of fetal distress, intermittent and continuous fetal heart rate assessments are screening, rather than diagnostic, techniques. Failure to appreciate this limitation may lead to inappropriate clinical decisions".

Improved Outcome?

Despite the apparently dismal correlation between FHR and condition at birth, the proponents of monitoring continued to express optimism and enthusiasm. Its use was based on the supposition that diagnosing fetal distress and intervening aggressively can make a significant difference in perinatal mortality and morbidity, in particular to the rate of intrapartum death.[5]

The first reports on the clinical use of EFM were descriptive, and more concerned with the practicality of implementing monitoring than with its results.

Paul and Hon in 1970[13] reported that the monitoring of 245 high risk patients indicated that "beneficial maternal results can be expected and salutary fetal results are suggested"—and "the clinical outcome appears to be better".

Beard et al[14] monitored 392 patients in 1971 and concluded "the experience . . . has clearly demonstrated that monitoring of high risk patients is a practical possibility and can become a part of the routine practice of most labour wards", although they also confessed "it is difficult to evaluate the clinical advantages of continuous monitoring over the conventional approach using the fetal stethoscope".

Gabert[10] suggested that, "In order to decrease the number of low scoring infants, intensive monitoring is imperative in all labors. A decrease in fetal mortality and, hopefully, morbidity rates should be the result of monitoring."

Shenker[11] was more cautious. "External monitoring methods currently available permit routine monitoring of all patients in labor. Whether monitoring all normal patients will improve fetal health and survival is still an unanswered question."

Following this series of descriptive reports, the results of uncontrolled trials of EFM began to appear in the obstetric literature.

Paul[15] in 1972 compared the results of 2,933 monitored labors with 10,885 unmonitored deliveries, and found that ". . . the perinatal death rates were less in the monitored than the unmonitored groups. Though the differences in rates were not statistically significant in the classical sense, even the similarity is important. This is the case since all monitored patients had 'high

risk' conditions, and such a group would normally be expected to contribute approximately two thirds of the perinatal losses."

Kelly and Kulkarni[16] in the next year reported the comparison of 150 monitored cases with 17,000 unselected deliveries conducted eight years previously. They concluded that "the results favored the monitored group".

Paul and Hon[17] surveyed 6,973 monitored versus 21,658 unmonitored labors and found that "the data seem to support the premise that clinical fetal monitoring is associated with improved perinatal outcome".

Lee and Baggish[18] and Edington et al[19] both published series comparing the perinatal mortality rates in monitored patients with rates in unmonitored patients from previous years, concluding on the basis of a fall in the rates, that EFM was associated with improved outcome.

Studies like these are frequently cited to confirm the benefits of fetal monitoring and yet, because they are all uncontrolled non-random studies they graphically demonstrate the real dangers inherent in interpreting such surveys. In each case alternate explanations may explain the results.

The studies quoted claim success for one of two reasons:

1. The perinatal mortality rate in the high risk monitored group was the same as or lower than in the low risk unmonitored group. The outcome was therefore improved because a higher death rate would be expected in the high risk group.

That may be true. Alternatively

—the results may reflect the inaccuracy of high risk scoring. Maybe the 'high risk labors' were not high risk at all.

—it may be that 'hopeless' cases—for example, babies of low gestational age that were not expected to survive—were not monitored, thus affecting the death rates in the so-called 'low risk' group. This certainly seems to have been the case in Paul and Hon's study.

—other factors may have benefited the monitored groups—for example, more intensive medical and nursing care.

2. The perinatal mortality rate was lower in monitored patients when compared with unmonitored patients in previous years.

Comparisons made retrospectively are particularly fraught with uncertainty. During the 1970s, perinatal mortality rates were falling generally as a result of improved maternal health and obstetric care. Lee and Baggish[18] were at least frank in interpreting their apparently favorable results: they commented that it would be simplistic to attribute such results to monitoring alone.

Paul et al[20] in a study published in 1977 noted that "during the five years of the study, there was a progressive downward trend in perinatal mortality. Multiple factors which no doubt contributed to improved outcome included more comprehensive management of complicated medical-obstetric problems, improved obstetric anesthesia, vigorous procedures for newborn resuscitation and broadened capacity for neonatal intensive care. Other factors which also exerted their impact during this time were a liberalized approach to abortion, a trend towards cesarean delivery in breech presentation, and the introduction of continuous methods of intrapartum monitoring. To isolate or singly qualitate any one of the foregoing factors is virtually impossible".

The same author[15] had earlier hit the nail on the head when, following the presentation of an uncontrolled study, he noted that "the ultimate answer regarding perinatal death and the value of monitoring will come only when a well controlled 'blind' study is done".

Results of the first controlled trial were published in 1976 by Renou et al.[21] It was a trial of total fetal intensive care rather than just EFM; 350 high risk patients were randomly assigned to control and intensive care groups. Although neonatal mortality and Apgar scores were similar in the two groups, the incidence of neurological abnormalities at birth was higher in the auscultation group, and more of the infants in this group subsequently required intensive care. The authors concluded that "the trial clearly showed that (fetal) intensive care is associated with improved neurologic and biochemical status of the neonate; however, it is possible that this improvement results from the use of fetal diagnostic tests or some other factor associated with intensive care".

The study by Haverkamp et al[22] was the first randomized trial to examine the effect of intrapartum EFM alone. A prospective randomized study of 483 high risk obstetric patients in labor compared the effectiveness of electronic fetal monitoring with auscultation of fetal heart tones. The infant outcome was measured by neonatal death, Apgar scores, cord blood gases, and neonatal nursery morbidity. There were no differences in the infant outcomes in any measured category between the electronically monitored group and the auscultated group.

The authors speculated in their discussion on why the auscultated group fared so well. Did the results reflect the accuracy of the auscultation? "There are subtle, less obvious factors involved in the actual care of laboring patients which could influence infant outcome. In this study, for example, the patients who were auscultated had individualized nursing care. . . . The authors have the impression that the reassuring psychological atmosphere created by personal nurse interaction and the absence of the recording machine in auscultated patients contributed to the excellent infant outcome in auscultated patients".

Kelso and his colleagues,[23] in 1978, were the first to perform a randomized controlled trial of EFM in low-risk patients. Their study of 504 patients compared continuous EFM with intermittent auscultation. There was no significant difference between the two groups in neonatal deaths, Apgar scores, maternal and neonatal morbidity, and cord blood gases.

Haverkamp,[24] in 1979, conducted yet another controlled prospective study. This time 690 high risk obstetric patients were randomly assigned to one of three monitoring groups—auscultation, electronic fetal monitoring alone, or electronic monitoring with the option for scalp sample. There were no differences in immediate outcomes in any measured category (Apgar scores, cord blood gases, neonatal death, neonatal morbidity, nursery course) among the three groups. The children were followed up at age nine months,[25] and again there were no differences between the groups.

None of the controlled studies examined the effect of EFM on low birthweight babies, a group in which there may be potential benefit. The studies contained too few patients to pick up significant difference if the benefit of EFM is small.

Haverkamp[24] commented on this latter problem: "Combining the two

controlled trials (the ones conducted by his group) totals almost 1,000 patients who were followed clinically in labor by either electronic monitoring or auscultation. Perinatal outcomes were the same in all measured categories and included no intrapartum deaths. There were five neonatal deaths, one in the auscultated and four in the electronically monitored groups. To attempt to show a beneficial effect of monitoring under the conditions of those two studies would epidemiologically require an enormous number of term high-risk patients, as the adverse effects or end points being used seem to be very infrequent''.

Neutra et al,[26] recognizing the difficulty of including sufficient numbers of patients in controlled trials, attempted a non-experimental statistical survey of the data from 15,846 live infants to assess the effect of electronic fetal monitoring on neonatal death rates. Using a statistical model they found that ''the majority of babies have a risk of neonatal death at or below 1/1,000. Even if fetal monitoring reduced their risk to zero, its absolute benefit could not exceed one life saved for every 1,000 babies monitored. Thus, the major effect of monitoring may be expected among the small group of infants whose risk is high enough to allow substantial reduction''. The high risk group that they considered next likely to benefit from monitoring was premature babies with one or more risk factors. They concluded that the use of EFM in the 26% of labors with demonstrable risk factors would avert 87% of the potentially preventable neonatal deaths.[5]

Does electronic fetal monitoring result in an improved outcome when compared with traditional auscultatory methods? According to the controlled trials published so far the answer seems to be no—but statistical analysis of a sufficient number of labors seems to indicate benefit to a very specific group of premature infants with demonstrable risk factors.

The Task Force on Electronic Fetal Monitoring[12] states, ''The weight of present evidence from prospective and retrospective analyses shows no apparent effect of electronic fetal monitoring upon perinatal mortality and morbidity in low-risk pregnancies. As maternal and fetal risk increases, there is a trend suggesting a beneficial effect of electronic fetal monitoring upon intrapartum and neonatal morbidity and mortality. Specific obstetric risk factors especially amenable to intervention via electronic fetal monitoring have not yet been completely enumerated''. However, the report suggests some of the high risk situations in which EFM should be strongly considered. These include 1. prematurity, postmaturity and intrauterine growth retardation, 2. medical complications of pregnancy, 3. meconium staining of the amniotic fluid, 4. use of oxytocin in labor and 5. the presence of abnormal auscultatory findings.

Side Effects?

The most obvious risks of EFM are those associated with the invasive part of the procedure when internal monitors are used. Both uterine perforations in the mother and scalp abscesses in the baby have been reported as complications of monitoring.[5] Monitored patients consistently show higher rates of postpartum infections, whether or not an internal monitor is used.[5, 22] Why this should be so is unexplained.

The psychological effects of EFM have not been well documented. Monica Starkman[27] interviewed 35 women after delivery. On the basis of this small series she comments: ''It can be predicted . . . that women with problems in prior pregnancies, particularly fetal losses, will respond most favorably to the fetal monitor. Their perception of the monitor as a protection against the disaster which they had previously experienced apparently overshadows the perception or recall of actual disadvantages. Women with no previous delivery experience, or prior normal labors and no fetal losses, will tend to recognize the benefits of the monitor, but will also respond negatively to its disadvantages''.

It may be that the greatest benefit of auscultation, as compared with EFM, is the presence of a reassuring nurse. Monitors have not yet replaced the human touch and Munsick[28] comments that ''perhaps worst of all, EFM has dehumanized obstetrics. We cannot divert our eyes or ears from EM's alluring LEDs, beeps and stylus chattering graphs. We no longer listen to, talk with, gaze upon or touch our patient''.

Youngs and Starkman[29] pick up this point, ''The potential for a beneficial or detrimental response (to EFM) . . . depends on sensitive obstetric management. Whether fetal monitoring will unnecessarily contribute to fear and anxiety during childbirth or serve to alleviate it will inevitably depend on how monitoring is introduced to the patient, how intelligently it is used, and how well it is integrated into the total plan for obstetric care''.

Another potentially serious side effect of EFM is the link that has been made between monitoring and an increase in the cesarean section rate. Whether such a link exists or not remains contentious.

All the uncontrolled studies mentioned earlier,[10, 11, 13-18, 20] with the exception of that by Edington et al,[19] reported a rise in the cesarean section rate in monitored versus unmonitored patients. In some cases the increase was dramatic: in Paul's 1972 study,[15] the rate in the unmonitored group was 3.5%, and in the monitored patients 17.5%. He comments: ''Although the use of cesarean delivery for clinical fetal distress may dramatically decline with monitoring systems, the overall incidence of cesarean delivery will usually be increased in monitored patients''. He found a similar rise in his 1977 study[20] when the unmonitored section rate was seven percent compared with 16% in the monitored labors.

Lee and Baggish[18] noted a change from 7.3% to 10.4% as the result of monitoring. In their study, of all monitored labors terminated by cesarean section for fetal distress, in only 50% did the baby show a lowered Apgar score!

However, for the same reasons that improved perinatal outcome cannot be claimed in uncontrolled series, so these results cannot be used to prove an increase in cesarean section in the monitored patients. Many other factors may have influenced the decision to intervene in what were usually obstetrically complicated labors.

Of much more significance are the results of the four random controlled prospective studies,[21-24] all of which demonstrated an increase in cesarean sections amongst monitored patients. In Renou's study[21] the section rate rose from 13.7% to 22.3% with monitoring, in Haverkamp's first study[22] it rose from 6.8% to 16.5% and in the second study[24] they noted a similar rise from six percent to 18%. Kelso et al[23] found a section rate of 9.5% in their monitored group as compared to 4.4% in the control group.

It seems significant that in most studies there is an increased section rate not only on the grounds of fetal distress, but also for other indications—for example, failure to progress.[24] It is hard to escape the conclusion, from the studies so far published, that the monitored patient is indeed at greater risk for cesarean section. The presence of the monitor appears in some way to encourage an interventionist approach to delivery. It may be, as the Task Force report quoted earlier warns, that failure to appreciate that the assessment of the continuous fetal heart rate is a screening, rather than a diagnostic technique, may lead to inappropriate clinical decisions.

Munsick[28] in his commentary on the second study by Haverkamp makes some interesting and provocative comments: ". . . there can be no doubt that the cesarean section rate doubles in association with, if not because of, EM. If Neutra and his associates are correct in estimating that EM may save one in 1,500 or more infants, let's extrapolate these data in terms of what is seldom mentioned in this enormously important controversy—maternal deaths. The cesarean section mortality rate is at least one in 1,000 operations. In 1975, there were 3,150,000 live U.S. births. If EM saves one in 1,500, it would have saved 2,000 babies in 1975 if applied to all laboring parents. Assuming an eight percent overall cesarean section rate without EM, 240,000 cesarean deliveries would have occurred in 1975 with 240 maternal deaths. Doubling the cesarean rate with EM would then kill 480 women. For 2,000 babies saved we have sacrificed 240 women—one woman for eight babies. Should not this information be provided to gravidas before obtaining their informed consent for EM?"

Are there any untoward side effects that may make fetal monitoring undesirable? The answer seems to be yes—as long as monitoring is imposed in a thoughtless and insensitive way, and as long as it promotes an interventionist obstetric approach that results in inappropriate cesarean sections.

Conclusion

Should all mothers be monitored?

On the basis of the available evidence the answer has to be 'no'. There is no rational indication for the use of EFM in low risk pregnancies. It may put the mother at increased risk and periodic auscultation of the fetal heart rate is an acceptable method of assessing the fetal condition.[12]

Indeed there is some reason to suppose that *too many* labors are being monitored, rather than too few—but whether the evidence so far gathered will be enough to turn the obstetric tide remains to be seen.

"The problem that faces us . . . is the almost simultaneous introduction of a series of tests of fetal performance in utero, accompanied by changes in delivery practice that derive partly from those new tests, but also from other considerations. . . . These new tests and altered practices are accompanied by falling neonatal death rates throughout the western world. The temptation is to establish coefficients of correlation between one test or practice and one outcome, like neonatal death, and then to make the blithe assumption that they are related in a cause-and-effect way. It will be very difficult . . . to unscramble scientific fact from fiction. But the attempt to unscramble must be made."[30] ◉

References

1. *Hobbins JC, Freeman R, Queenan JT: The fetal monitoring debate. Obstet Gynecol 1979; 54:103-109.*
2. *Goodlin RC: History of fetal monitoring. Am J Obstet Gynecol 1979; 133:323-352.*
3. *Walker N: The case for conservation in management of fetal distress. Br Med J 1959; 2:1221-1226.*
4. *Benson RC, Shubeck F, Deutschberger J, et al: Fetal heart rate as a predictor of fetal distress: A report from the collaborative project. Obstet Gynecol 1968; 32:259-266.*
5. *Banta HD, Thacker S: Assessing the costs and benefits of electronic fetal monitoring. Obstet Gynecol Surv 1979; 34:627-642.*
6. *Nochinson DJ, Cetrulo C: Intrapartum fetal monitoring. J Fam Pract 1977; 4:845-849.*
7. *Dept. of Clinical Epidemiology and Biostatistics, McMaster University Health Sciences Centre: How to read clinical journals. Part II. To learn about a diagnostic test. Can Med Assoc J 1981; 124:703-710.*
8. *Beard RW, Filshie GM, Knight CA, Roberts GM: The significance of the changes in the continuous fetal heart rate in the first stage of labour. J Obstet Gynaecol Br Comm 1971; 78:865-881.*
9. *Schifrin BS, Dame L: Fetal heart rate patterns: Prediction of Apgar score. JAMA 1972; 219:1322-1325.*
10. *Gabert HA, Stenchever MA: Continuous electronic monitoring of fetal heart rate during labor. Am J Obstet Gynecol 1973; 115:919-923.*
11. *Shenker L: Clinical experiences with fetal heart rate monitoring in one thousand patients in labor. Am J Obstet Gynecol 1973; 115:1111-1116.*
12. *Zuspan FP, Quilligan EJ, Iams JD, van Geijn HP: Predictors of intrapartum fetal distress: The role of electronic fetal monitoring. Am J Obstet Gynecol 1979; 135:287-291.*
13. *Paul RH, Hon EH: A clinical fetal monitor. Obstet Gynecol 1970; 35:161-169.*
14. *Beard RW, Brudenell JM, Feroze RM, Clayton SG: Intensive care of the high risk fetus in labour. J Obstet Gynaecol Br Comm 1971; 78:882-893.*
15. *Paul RH: Clinical fetal monitoring: Experience on a large clinical service. Am J Obstet Gynecol 1972; 113:573-577.*
16. *Kelly VC, Kulkarni D: Experiences with fetal monitoring in a community hospital. Obstet Gynecol 1973; 41:818-824.*
17. *Paul RH, Hon EH: Clinical fetal monitoring. V. Effect on perinatal outcome. Am J Obstet Gynecol 1974; 118:529-533.*
18. *Lee WK, Baggish MS: The effect of unselected intrapartum fetal monitoring. Obstet Gynecol 1976; 47:516-520.*
19. *Edington T, Sibanda J, Beard RW: Influence on clinical practice of routine intrapartum fetal monitoring. Br Med J 1975; 3:341-343.*
20. *Paul RH, Huey JR, Yaeger CF: Clinical fetal monitoring. Postgrad Med 1977; 61:160-166.*
21. *Renou P, Chang A, Anderson I, Wood C: Controlled trial of fetal intensive care. Am J Obstet Gynecol 1976; 126:470-476.*
22. *Haverkamp AD, Thompson HE, McFee JG, Cetrulo C: The evaluation of continuous fetal heart rate monitoring in high risk pregnancy. Am J Obstet Gynecol 1976; 125:310-320.*
23. *Kelso IM, Parsons RJ, Lawrence GF, et al: An assessment of continuous fetal heart rate monitoring in labor: A randomized trial. Am J Obstet Gynecol 1978; 131:526-532.*
24. *Haverkamp AD, Orleans M, Langendoerfer S, et al: A controlled trial of the differential effects of intrapartum fetal monitoring. Am J Obstet Gynecol 1979; 134:399-412.*
25. *Langendoerfer S, Haverkamp AD, Murphy D, et al: Pediatric follow-up of a randomized controlled trial of intrapartum fetal monitoring techniques. J Pediatr 1980; 97:103-107.*
26. *Neutra RR, Fienberg SE, Greenland S, Friedman EA: Effect of fetal monitoring on neonatal death rates. N Engl J Med 1978; 299:324-326.*
27. *Starkman MN: Fetal monitoring: Psychological consequences and management recommendations. Obstet Gynecol 1977; 50:500-504.*
28. *Munsick RA: Commentary on differential effects of intrapartum fetal monitoring. Am J Obstet Gynecol 1979; 134:409-411.*
29. *Youngs DD, Starkman MN: Psychological and physiological aspects of electronic fetal monitoring. Primary Care 1976; 3:691-700.*
30. *Hellegers EA: Fetal monitoring and neonatal death rates. N Engl J Med 1978; 299:357-358.*