39. Intrapartum Electronic Fetal Monitoring

RECOMMENDATION

Routine electronic fetal monitoring for low-risk women in labor is not recommended. There is insufficient evidence to recommend for or against intrapartum electronic fetal monitoring for high-risk pregnant women (see ***Clinical Intervention***).

Burden of Suffering

Intrapartum fetal asphyxia is an important cause of stillbirth and neonatal death. In the U.S. in 1993, an estimated 700 infant deaths (17.3/100,000 live births) were attributed to intrauterine hypoxia and birth asphyxia.[1] Some neonates with intrauterine hypoxia require resuscitation and other aggressive medical interventions for such complications as acidosis and seizures. Asphyxia has also been implicated as a cause of cerebral palsy, although most cases of cerebral palsy occur in persons without evidence of birth asphyxia or other intrapartum events.[2–5] Most fetuses tolerate intrauterine hypoxia during labor and are delivered without complications, but assessments suggesting fetal distress are associated with an increased likelihood of cesarean delivery (63% compared to 23% for all births).[6] The exact incidence of fetal distress is uncertain; a rate of 42.9/1,000 live births was reported from 1991 U.S. birth certificate data, with the highest rates in infants born to mothers under age 20 or over age 40, and in blacks.[7]

Accuracy of the Screening Test

The principal screening technique for fetal distress and hypoxia during labor is the measurement of fetal heart rate. Abnormal decelerations in fetal heart rate and decreased beat-to-beat variability during uterine contractions are considered to be suggestive of fetal distress. The detection of these patterns during monitoring by auscultation or during electronic monitoring (cardiotocography) increases the likelihood that the fetus is in distress, but the patterns are not diagnostic. In addition, normal or equivocal heart rate patterns do not exclude the diagnosis of fetal distress.[5] Precise information on the frequency of false-negative and false-positive results is lacking, however, due in large part to the absence of an accepted

definition of fetal distress.[8,9] For many years, acidosis and hypoxemia as determined by fetal scalp blood pH were used for this purpose in research and clinical practice, but it is now clear that neither finding is diagnostic of fetal distress.[5,10–12]

Electronic fetal heart rate monitoring can detect at least some cases of fetal distress, and it is often used for routine monitoring of women in labor. In 1991, the reported rate of electronic fetal monitoring in the U.S. was 755/1,000 live births.[7] The published performance characteristics of this technology, derived largely from research at major academic centers, may overestimate the accuracy that can be expected when this test is performed for routine screening in typical community settings. Two factors in particular that may limit the accuracy and reliability achievable in actual practice are the method used to measure fetal heart activity and the variability associated with cardiotocogram interpretations.

The measurement of fetal heart activity is performed most accurately by attaching an electrode directly to the fetal scalp, an invasive procedure requiring amniotomy and associated with occasional complications. This has been the technique used in most clinical trials of electronic fetal monitoring. Other noninvasive techniques of monitoring fetal heart rate, which include external Doppler ultrasound and periodic auscultation of heart sounds by clinicians, are more appropriate for widespread screening but provide less precise data than the direct electrocardiogram using a fetal scalp electrode. In studies comparing external ultrasound with the direct electrocardiogram, about 20–25% of tracings differed by at least 5 beats per minute.[13,14]

A second factor influencing the reliability of widespread fetal heart rate monitoring is inconsistency in interpreting results. Several studies have documented significant intra- and interobserver variation in assessing cardiotocograms even when tracings are read by experts in electronic fetal monitoring.[15–17] It would be expected that routine performance of electronic monitoring in the community setting with interpretations by less experienced clinicians would generate a higher proportion of inaccurate results and potentially unnecessary interventions than has been observed in the published work of major research centers.

Effectiveness of Early Detection

A potentially more important issue is whether electronic evidence of fetal distress during labor results in benefit to either the fetus or mother. Observational studies in the 1960s and 1970s suggested that electronic fetal monitoring during labor reduced the risk of intrapartum stillbirth, neonatal death, and developmental disability, but methodologic problems in these largely retrospective studies left the issue unsettled.[4,8] Ten random-

ized controlled trials and four meta-analyses of electronic fetal monitoring have since been published, all of which compared electronic monitoring, with or without fetal scalp blood sampling, to active clinical monitoring including intermittent auscultation by trained personnel. Three trials in low-risk women,[18–20] the largest of which involved nearly 13,000 patients,[18] compared continuous electronic monitoring to intermittent auscultation; where described, auscultation was performed at least every 15 minutes during the first stage of labor[18,20] and between each contraction during the second stage.[20] Two trials included scalp blood sampling.[19,20] These trials found no significant differences between the study groups in intrapartum or perinatal deaths, maternal or neonatal morbidity, Apgar scores, umbilical cord blood gases, the need for assisted ventilation, or admission to the special care nursery. The results of one of these trials[19] may have been biased by the method of randomization, however, which resulted in a large disparity in the distribution of primigravidae between the study groups. Similarly, no differences in clinical outcomes were reported in a subgroup analysis of low-risk women enrolled in a prospective study of nearly 35,000 pregnancies in which routine monitoring was compared with selective monitoring of high-risk pregnancies.[21,22] A controlled trial[23] that assigned intervention by week of admission also reported no effect of electronic fetal monitoring on low Apgar scores, admissions to special care nurseries, or neonatal infection. A trial from Greece carried out in predominantly low-risk pregnant women found no differences in most neonatal outcome measures, but reported a significant reduction in perinatal mortality rates (2.6 compared to 13/1,000 total births).[24] This study may not be generalizable to the U.S., however, given higher perinatal mortality and substantially lower cesarean delivery rates (<10%) than are typical in the U.S. In addition, the method of randomization and the large disparity in numbers between study and control group (746 *vs.* 682 women) raise the possibility of biased randomization.

The potential benefits of electronic fetal monitoring during labor have also been examined in high-risk pregnancies. Four clinical trials in developed countries found that electronic fetal heart rate monitoring in high-risk pregnancies, with or without scalp blood sampling, was of limited benefit when compared with intermittent auscultation during labor.[25–28] Neonatal death, Apgar scores, cord blood gases, and neonatal nursery morbidity were unchanged in three of the trials,[26–28] all of which performed intermittent auscultation systematically in control women: every 15 minutes in the first stage of labor and every 5 minutes in the second stage. The fourth trial found that continuous monitoring was associated with improved umbilical cord blood gases and neurologic symptoms and signs, and decreased need for intensive care.[25] This study has been criticized, however, because monitoring techniques in the control group were poorly

described and one physician withdrew his patients from the control group after the trial began.[8,29] Results from a fifth trial in high-risk pregnant women in Zimbabwe are unlikely to be applicable to obstetric care in the U.S.[30]

Meta-analyses[31–33] that included all but the two most recently published randomized controlled trials[24,30] cited above reported no effect of electronic fetal monitoring on low Apgar scores, admissions to special care nurseries, or neonatal infection. With electronic fetal monitoring combined with scalp blood sampling, the relative risk of intrapartum death was 0.81 (95% confidence interval, 0.22 to 2.98) and of perinatal death was 0.98 (95% confidence interval, 0.58 to 1.64) when compared to intermittent auscultation. Relative risk of perinatal mortality when electronic fetal monitoring without blood sampling was used was 1.94 (95% confidence interval, 0.2 to 18.62). A meta-analysis of all trials from developed countries also reported no significant effect on overall perinatal mortality (typical odds ratio 0.87; 95% confidence interval, 0.57 to 1.33).[33a] The confidence intervals around these point estimates of the risk of perinatal death are wide, indicating that sample size is insufficient to exclude the possibility of clinically important increases or declines in mortality. One meta-analysis reported a significant reduction in perinatal mortality due to fetal hypoxia, but the method for attributing deaths to hypoxia was not standardized.[33a] The results appeared to be strongly influenced by the inclusion of one trial with questionable randomization methods and generalizability to the U.S. (see above);[24] a sensitivity analysis to examine the effect of excluding this trial from the meta-analysis was not reported.

Although most outcome measures in these studies were not influenced by electronic fetal monitoring, there is evidence that it reduces the incidence of neonatal seizures. This was suggested in early research[25,34] and confirmed in the Dublin trial of low-risk women.[20] This study reported a statistically significant reduction in the rate of neonatal seizures when continuous intrapartum fetal monitoring was compared with intermittent auscultation. Secondary analysis suggested that the reduced risk was limited to labors that were prolonged or induced or augmented with oxytocin. In a meta-analysis of the controlled trials that included scalp blood sampling as an adjunct, the odds of neonatal seizures were reduced by about one half with electronic monitoring.[31] A separate meta-analysis found no effect of electronic monitoring on neonatal seizures when no scalp blood sampling was performed,[32] raising the possibility that the benefit may have been due to the blood sampling rather than the electronic monitoring. What also remains unclear is the extent to which infants benefit from the prevention of neonatal seizures by monitoring. Seizures have been viewed by many as a poor prognostic indicator; in the Dublin trial, death occurred in 23% of the babies who experienced seizures, and autopsy confirmed that at least

two thirds of these deaths were due to asphyxia during labor.[20] There are few prospective data on whether the prevention of neonatal seizures reduces the risk of neonatal death or long-term neurologic sequelae. The neonatal seizures prevented by electronic monitoring may not be those associated with long-term impairment.[20,31] At 4-year follow-up of survivors after seizures in the Dublin trial, the total number and rate with cerebral palsy (n = 3 and 0.5/1,000 enrolled subjects) were identical in the monitored and control groups.[35]

None of the three trials reporting longer term follow-up found that electronic fetal monitoring improved neurologic or developmental outcomes. A follow-up study of the growth and development at 9 months of age of infants involved in the second Denver trial[27] failed to show any long-term benefits of electronic fetal monitoring; the direction of the effect on mental and psychomotor development scores suggested increased risk in the monitored group.[36] In the Dublin trial,[20] the overall rates of cerebral palsy at 4-year follow-up were 1.8/1,000 in the electronically monitored group and 1.5/1,000 in the auscultation group.[35] Eighteen-month follow-up in a trial in high-risk women[28] revealed little difference in mean mental or psychomotor development scores on the Bayley Scales, but cerebral palsy and low mental development scores were both significantly more common in the electronically monitored group.[37] Cerebral palsy was associated with an increased duration of abnormal fetal heart rate patterns and time to delivery after diagnosis of such patterns in the electronically monitored group. Meta-analyses combining these three studies confirm little benefit from monitoring on adverse neurologic outcomes.[31,32]

Any potential benefit of intrapartum monitoring must be weighed against the potential risks associated both with diagnostic procedures and operative interventions for fetal distress. The insertion of fetal scalp electrodes, for example, is generally a safe procedure, but it may occasionally cause umbilical cord prolapse or infection due to early amniotomy; electrode or pressure catheter trauma to the eye, fetal vessels, umbilical cord, or placenta; and scalp infections with Herpes hominis type 2 or group B streptococcus.[10] Concerns have also been raised about the potential for enhancing transmission of human immunodeficiency virus (HIV) infection by the use of scalp electrodes.[38] Meta-analysis of randomized controlled trials indicates no increased risk of neonatal infection from electronic fetal monitoring compared to intermittent auscultation.[33] Perhaps the most important complication of intrapartum electronic fetal monitoring is the increased performance of cesarean delivery, an operation associated with maternal and neonatal morbidity and a small but measurable operative mortality.[39,40] Fetal distress is a common indication for cesarean delivery, and all trials showed a higher cesarean delivery rate in the electronically monitored group. The randomized controlled trials

from the 1970s reported that cesarean delivery was performed significantly more frequently in association with electronic fetal monitoring.[18,19,25–27] In recent years, an effort has been made to lower the frequency of cesarean delivery, and four of five trials carried out in developed countries in the 1980s or 1990s reported no significant increase in the overall cesarean delivery rate with electronic fetal monitoring.[20,23,24,28] A fifth trial, comparing routine to selective electronic monitoring, reported a very small increase that was statistically but not clinically significant.[21] On the other hand, operative vaginal (e.g., forceps) deliveries were significantly increased in the newer trials,[20,23,24] suggesting an inverse relationship between cesarean and operative vaginal delivery. The meta-analyses[31,32,33a] previously cited reported a 1.3- to 2.7-fold increased likelihood of cesarean delivery and a 2.0- to 4.1-fold increased likelihood of cesarean delivery for fetal distress with continuous electronic fetal monitoring, with lower rates in the meta-analysis of studies that used scalp blood sampling. The likelihood of any operative delivery was increased by about 30% with electronic fetal monitoring. The meta-analyses also reported higher rates of both maternal infection and general anesthesia with electronic monitoring, presumably secondary to the higher rates of operative delivery.[31,32] Electronic monitoring may also have adverse psychological effects. In a comparison of subsamples from the randomized groups in one trial, women who had electronic fetal monitoring reported an increased likelihood of feeling "too restricted" during labor and were also more likely to report feeling left alone, although the latter difference was of only borderline significance.[41] On the other hand, in a subsample from a different trial, there were no differences between women in the two groups in their assessment of their monitoring experience, medical or nursing support, or the labor or delivery experience.[42]

Recommendations of Other Groups

The American College of Obstetricians and Gynecologists states that all patients in labor need some form of fetal monitoring, with more intensified monitoring indicated in high-risk pregnancies; the choice of technique (electronic fetal monitoring or intermittent auscultation) is based on various factors, including the resources available.[43] The Canadian Task Force on the Periodic Health Examination advises against routine electronic fetal monitoring in normal pregnancies but found poor evidence regarding the inclusion or exclusion of its routine use in high-risk pregnancies.[44]

Discussion

Electronic fetal monitoring has become an accepted standard of care in many settings in the U.S. for the management of labor.[4] Birth certificate data suggest that this technology was used in about three fourths of all live

births in 1991;[7] in certain academic centers the rate may be as high as 86–100%.[4] As discussed above, there are important questions regarding the definition of fetal distress, as well as about the accuracy and reliability of electronic fetal monitoring in discriminating accurately between pregnancies with and without this disorder. It is also unclear whether the use of this technology results in significantly improved outcome for the baby when compared to active clinical monitoring. Adequately conducted trials generalizable to obstetric care in the U.S. have not reported a reduction in perinatal mortality, although sample sizes are not adequate to exclude a benefit. Evidence does support a reduced risk of neonatal seizures, but the benefit was mainly seen in women with complicated labors (i.e., induced, augmented with oxytocin, or prolonged), and it is not clear that there are long-term adverse effects associated with the types of seizures prevented. Follow-up of study subjects at 9 months to 4 years of age has not revealed any long-term neurologic benefits from electronic monitoring. If anything, effect estimates suggest an increased risk of cerebral palsy and low developmental scores in electronically monitored infants, possibly due to false reassurance and consequent delayed intervention.

In addition to the maternal risks associated with electronic fetal monitoring, including increased rates of cesarean or operative vaginal (e.g., forceps) delivery, general anesthesia and maternal infection, and the possible increased risk of adverse neonatal neurologic outcome, increased use of this technology is associated with increased costs of labor care. The widespread use of electronic fetal monitoring in low-risk pregnancies in the face of uncertain benefits, and certain maternal risks and costs, has been attributed to concerns about litigation.[8,45] It has been estimated that nearly 40% of all obstetric malpractice losses are due to fetal monitoring problems,[46] and this may be a major motivating factor behind the widespread use of electronic fetal monitoring during labor.

CLINICAL INTERVENTION

Routine electronic fetal monitoring is not recommended for low-risk women in labor when adequate clinical monitoring including intermittent auscultation by trained staff is available (“D” recommendation). There is insufficient evidence to recommend for or against electronic fetal monitoring over intermittent auscultation for high-risk pregnancies (“C” recommendation). For pregnant women with complicated labor (i.e., induced, prolonged, or oxytocin augmented), recommendations for elee tronic monitoring plus scalp blood sampling may be made on the basis of evidence for a reduced risk of neonatal seizures, although the long-term neurologic benefit to the neonate is unclear and must be weighed against the increased risk to the mother and neonate of operative delivery, general

anesthesia, and maternal infection, and a possible increased risk of adverse neurologic outcome in the infant. There is currently no evidence available to evaluate electronic fetal monitoring in comparison to no monitoring.

The draft update of this chapter was prepared for the U.S. Preventive Services Task Force by Carolyn DiGuiseppi, MD, MPH, based in part on materials prepared by Geoffrey Anderson, MD, PhD, for the Canadian Task Force on the Periodic Health Examination.

REFERENCES

1. National Center for Health Statistics. Annual summary of births, marriages, divorces, and deaths: United States, 1993. Monthly vital statistics report; vol 42, no 13. Hyattsville, MD: Public Health Service, 1994.
2. Freeman JM, Nelson KB. Intrapartum asphyxia and cerebral palsy. Pediatrics 1988;82:240–249.
3. Nelson KB, Ellenberg JH. Antecedents of cerebral palsy. Multivariate analysis of risk. N Engl J Med 1986;315:81–86.
4. Shy KK, Larson EB, Luthy DA. Evaluating a new technology: the effectiveness of electronic fetal heart rate monitoring. Ann Rev Public Health 1987;8:165–190.
5. Goodlin RC, Haesslein HC. When is it fetal distress? Am J Obstet Gynecol 1977;128:440–445.
6. Taffel SM. Cesarean delivery in the United States, 1990. National Center for Health Statistics. Vital Health Statistics, Series 21, no. 51. Washington, DC: Government Printing Office, 1994. (Publication no. DHHS (PHS) 94-1929.)
7. National Center for Health Statistics. Advance report of maternal and infant health data from the birth certificate, 1991. Monthly vital statistics report; vol 42, no 11. Hyattsville, MD: Public Health Service, 1994.
8. Prentice A, Lind T. Fetal heart rate monitoring during labour: too frequent intervention, too little benefit? Lancet 1987;2:1375–1377.
9. American College of Obstetricians and Gynecologists Committee on Obstetric Practice. Fetal distress and birth asphyxia. Committee Opinion no. 137. Washington, DC: American College of Obstetricians and Gyecologists, 1994.
10. Pritchard JA, MacDonald PC, Gant NF. Williams obstetrics, 17th ed. Norwalk, CT: Appleton-Century-Crofts, 1985: 281–293.
11. Perkins RP. Perinatal observations in a high-risk population managed without intrapartum fetal pH studies. Am J Obstet Gynecol 1984;149:327–334.
12. Clark SL, Paul RH. Intrapartum fetal surveillance: the role of fetal scalp blood sampling. Am J Obstet Gynecol 1985; 153:717–720.
13. Suidan JS, Young BK, Hochberg HM, et al. Observations on perinatal heart rate monitoring. II. Quantitative unreliability of Doppler fetal heart rate variability. J Reprod Med 1985;30:519–522.
14. Boehm FH, Fields LM, Hutchison JM, et al. The indirectly obtained fetal heart rate: comparison of first- and second-generation electronic fetal monitors. Am J Obstet Gynecol 1986;155:10–14.
15. Cohen AB, Klapholz H, Thompson MS. Electronic fetal monitoring and clinical practice: a survey of obstetric opinion. Med Decis Making 1982;2:79-95.
16. Beaulieu MD, Fabia J, Leduc B, et al. The reproducibility of intrapartum cardiotocogram assessments. Can Med Assoc J 1982;127:214–216.
17. Nielsen PV, Stigsby B, Nickelsen C, et al. Intra- and inter-observer variability in the assessment of intrapartum cardiotocograms. Acta Obstet Gynecol Scand 1987;66:421–424.
18. 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;131:526–531.
19. Wood C, Renou P, Oats J, et al. A controlled trial of fetal heart rate monitoring in a low-risk obstetric population. Am J Obstet Gynecol 1981;141:527–534.
20. MacDonald D, Grant A, Sheridan-Pereira M, et al. The Dublin randomized controlled trial of intrapartum fetal heart rate monitoring. Am J Obstet Gynecol 1985;152:524–539.
21. Leveno KJ, Cunningham FG, Nelson S, et al. A prospective comparison of selective and universal electronic fetal monitoring in 34,995 pregnancies. N Engl J Med 1986;315:615–619.

22. Neilson JP. Liberal vs. restrictive use of EFM in labour (low-risk labours). In: Enkin MW, Keirse MJNC, Renfrew MJ, Neilson JP, eds. Pregnancy and childbirth module. Cochrane database of systematic reviews: review no. 03886, 12 May 1994, "Cochrane Updates on Disk." Oxford: Update Software, 1994, Disk Issue 1.
23. Neldam S, Osler M, Hansen PK, et al. Intrapartum fetal heart rate monitoring in a combined low- and high-risk population: a controlled clinical trial. Eur J Obstet Gynecol Reprod Biol 1986;23:1–11.
24. Vintzileos AM, Antsaklis A, Varvarigos I, et al. A randomized trial of intrapartum fetal heart rate monitoring versus intermittent auscultation. Obstet Gynecol 1993;81:899–907.
25. Renou P, Chang A, Anderson I, et al. Controlled trial of fetal intensive care. Am J Obstet Gynecol 1976;126:470–476.
26. Haverkamp AD, Thompson HE, McFee JG, et al. The evaluation of continuous fetal heart rate monitoring in high-risk pregnancy. Am J Obstet Gynecol 1976;125:310–317.
27. Haverkamp AD, Orleans M, Langendoerfer S, et al. A controlled trial of the differential effects of intrapartum fetal monitoring. Am J Obstet Gynecol 1979;134:399–409.
28. Luthy DA, Shy KK, van Belle G, et al. A randomized trial of electronic fetal monitoring in preterm labor. Obstet Gynecol 1987;69:687–695.
29. Thacker SB. The efficacy of intrapartum electronic fetal monitoring. Am J Obstet Gynecol 1987;156: 24–30.
30. Mahomed K, Nyoni R, Mulambo T, et al. Randomised controlled trial of intrapartum fetal heart rate monitoring. BMJ 1994;308:497–500.
31. Neilson JP. EFM + scalp sampling vs. intermittent auscultation in labour. In: Enkin MW, Keirse MJNC, Renfrew MJ, Neilson JP, eds. Pregnancy and childbirth module. Cochrane database of systematic reviews: review no. 03297, 4 May 1994, "Cochrane Updates on Disk." Oxford: Update Software, 1994, Disk Issue 1.
32. Neilson JP. EFM alone vs. intermittent auscultation in labour. In: Enkin MW, Keirse MJNC, Renfrew MJ, Neilson JP, eds. Pregnancy and childbirth module. Cochrane database of systematic reviews: review no. 03298, 4 May 1994, "Cochrane Updates on Disk." Oxford: Update Software, 1994, Disk Issue 1.
33. Neilson JP. EFM vs. intermittent auscultation in labour. In: Enkin MW, Keirse MJNC, Renfrew MJ, Neilson JP, eds. Pregnancy and childbirth module. Cochrane database of systematic reviews: review no. 03884, 4 May 1994, "Cochrane Updates on Disk." Oxford: Update Software, 1994, Disk Issue 1.
33a. Vintzileos AM, Nochimson DJ, Guzman ER, et al. Intrapartum electronic fetal heart rate monitoring versus intermittent auscultation: a meta-analysis. Obstet Gynecol 1995;85:149–155.
34. Chalmers I. Randomized controlled trials of intrapartum monitoring. In: Thalhammer O, Baumgarten KV, Pollak A, eds. Perinatal medicine. Stuttgart: Georg Thieme, 1979:260–265.
35. Grant A, O'Brien N, Joy M-T, et al. Cerebral palsy among children born during the Dublin randomised trial of intrapartum monitoring. Lancet 1989;ii:1233–1236.
36. Langendoerfer S, Haverkamp AD, Murphy J, et al. Pediatric follow-up of a randomized controlled trial of intrapartum fetal monitoring techniques. J Pediatr 1980;97:103–107.
37. Shy KK, Luthy DA, Bennett FC, et al. Effects of electronic fetal-heart-rate monitoring, as compared with periodic auscultation, on the neurologic development of premature infants. N Engl J Med 1990;322:588–593.
38. American College of Obstetricians and Gynecologists. Human immunodeficiency virus infections. Technical Bulletin no. 169. Washington, DC: American College of Obstetricians and Gynecologists, 1992.
39. American Academy of Pediatrics and American College of Obstetricians and Gynecologists. Guidelines for perinatal care. 3rd ed. Elk Grove Village, IL: American Academy of Pediatrics, 1992.
40. Pearson J, Rees G. Technique of caesarean section. In: Chalmers I, Enkin M, Keirse MJNC, eds. Effective care in pregnancy and childbirth, volume 2: childbirth. Oxford: Oxford University Press, 1989:1234–1269.
41. Garcia J, Corry M, MacDonald D, et al. Mothers' views of continuous electronic fetal heart monitoring and intermittent auscultation in a randomised controlled trial. Birth 1985;12:79–85.
42. Killien MG, Shy K. A randomized trial of electronic fetal monitoring in preterm labor: mothers' views. Birth 1989; 16:7–12.
43. American College of Obstetricians and Gynecologists. Intrapartum fetal heart rate monitoring. Technical Bulletin no. 132. Washington, DC: American College of Obstetricians and Gynecologists, 1989.
44. Canadian Task Force on the Periodic Health Examination. Canadian guide to clinical preventive health care. Ottawa: Canada Communication Group, 1994:158–165.
45. Cunningham AS. Electronic fetal monitoring in labour. J R Soc Med 1987;80:783.
46. Frigoletto FD Jr, Nadel AS. Electronic fetal heart rate monitoring: why the dilemma? Clin Obstet Gynecol 1988;31: 179–183.