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Labor Management Evidence Update

Potential to Minimize Risk of Cesarean Birth in Healthy Women

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ABSTRACT

New evidence regarding normal parameters of labor progress for healthy women has the potential to minimize risk of cesarean birth and thereby enhance current and future maternal well-being if clinicians apply the research findings to obstetric practice. The economic and reproductive health consequences of the increasing cesarean birth rate in the United States are considerable; therefore, action on this issue by all stakeholders is necessary. Review and integration of the recent recommendations for labor management from experts convened by the Eunice Kennedy Shriver National Institute of Child Health and Human Development, the American College of Obstetricians and Gynecologists, and the Society for Maternal-Fetal Medicine are required to make maternity care in the United States as safe as possible.

Key Words: category II fetal heart rate tracings, cesarean birth, labor management, maternal morbidity, safe maternity care

Over the past decade, a number of studies have been published offering evidence that expectations of normal labor progress for healthy women need to be modified to be consistent with characteristics of the contemporary obstetric population and routine labor interventions. Childbearing women currently are older, heavier, and have more comorbidities than those in the past.[1–3] Elective induction of labor and epidural anesthesia for labor pain relief are common practices. Normal labor takes longer now than it did 50 years ago, in part because of these factors.[1–3] Incorporating the recent evidence regarding expectations of normal labor progress into clinical practice has the potential to enhance the safety of maternity care in the United States; however, uptake and adoption have been slow. Recent support and encouragement of professional organizations such as the American College of Obstetricians and Gynecologists (ACOG) and the Society for Maternal-Fetal Medicine (SMFM) through their cosponsorship of a meeting of experts at the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) on this issue[4] may serve to accelerate change. This change needs to occur now and be sustained to avoid realizing predictions of experts that by 2020, if primary and repeat cesarean birth rates continue to rise as they have in recent years, the cesarean birth rate will be more than 56% and there will be a related considerable rise in placenta previas, placenta accretas, and maternal deaths.[5] The purpose of this article was to discuss the implications of the rise in cesarean births in the United States, review the most recent evidence regarding labor progress for healthy women, and encourage adoption of recommendations for preventing the first cesarean birth recently offered by national experts.[4] Knowledgeable maternity care providers who are open to evidence-based changes can lead the way in promoting the safest care possible for childbearing women and their babies during the labor and birth process.

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SIGNIFICANCE: CURRENT ISSUES RELATED TO CESAREAN BIRTH IN THE UNITED STATES

Incidence

Since 1965, the cesarean birth rate in the United States has increased by approximately 630%, from 4.5 per 100 births to 32.8 per 100 births[6–8] (see Figure 1). However, the increase has not been linear. From 1965 to 1985, the cesarean birth rate increased more than 400%,

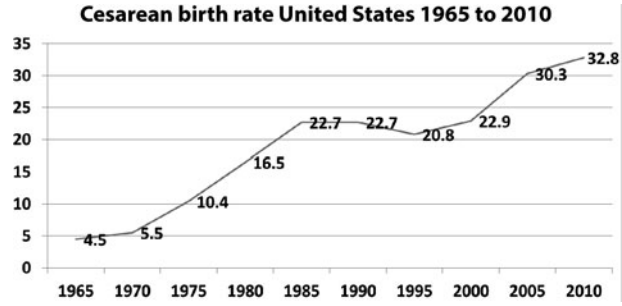

Figure 1. Cesarean birth rate in the United States from 1965 to 2010. Compiled from data presented in references Osterman and Martin,[7] Taffel et al,[8] MacDorman et al,[9] Placek and Taffel,[10] and Zahniser et al.[11]

then was relatively stable in the 20% range from 1985 to 2000, but has since increased approximately 43% since 2000.[6,7] It is now the most common surgical procedure performed in the United States.[12,13] These rates represent many women. In 2012, with a 32.8 cesarean birth rate, of the 3 952 936 births in the United States, 1 296 563 were via cesarean delivery.[6] Admittedly, there is no consensus among most experts on the ideal cesarean birth rate; however, in my opinion, 1 of 3 women having a cesarean birth is high. The National Priorities Partnership Maternity Action Task Force convened by the National Quality Forum suggested a 15% cesarean birth rate for healthy, low-risk women (nulliparous and at term with a singleton fetus in a vertex presentation) as an aspirational goal, acknowledging there is much work to be done to make this a reality.[14] A goal of minimizing unnecessary cesarean births without designating a precise "ideal" or "appropriate" rate may be a better option and something most clinicians can agree to support.

The lack of agreement about the ideal cesarean birth rate should not be a barrier to adopting evidence-based clinical practices that may avoid unnecessary cesarean births. Overuse of any surgical procedure is not in the best interest of patients specifically and the healthcare system in general.[14,15]

Variations in practice

While cesarean birth is at times medically necessary, in some cases, nonclinical variables such as the practice environment and individual provider preferences are contributing factors.[15] There is evidence that more subjective indications such as "nonreassuring" fetal status and arrest of dilation can be larger contributing factors to primary cesarean birth than more objective indications such as malpresentation and maternal-fetal and obstetric conditions.[16] These subjective indications may vary on the basis of providers. There are also significant differences among states, with the lowest rates of cesarean birth in Alaska, Idaho, New Mexico, and Utah and the highest rates in Florida, Louisiana, Mississippi, New Jersey, and West Virginia.[17] It would be helpful to know what factors are contributing to the differences between these high- and low-rate states, especially if the variance was found to be attributable to something that could be modified. For example, potential research questions include (*a*) what can be learned about clinical practice and the patient populations of the states with the lower rates of cesarean birth, and (*b*) could what is learned be applied in other states? Differences in practice among providers and clinical sites is associated with a 10-fold variation in cesarean birth rates in US hospitals, from a low of 7.1% to a high of 69.9%; for women with low-risk pregnancies, cesarean birth rates vary 15-fold, from 2.4% to 36.5%.[15] These differences in rates among regions, states, and individual providers offer significant opportunity for research to explore contributing and causative factors to cesarean birth in the United States.

Financial implications

It is likely that these major differences in practice are one of the reasons for the costly overuse of cesarean births in many US hospitals.[15] From 1997 to 2009, yearly costs of cesarean births in the United States increased from $3.7 billion to $7.4 billion, representing a 5.9% annual growth in costs.[18] From 1997 to 2009, hospital stays per 1000 women for cesarean births increased from 3.4 to 5.2 days, making cesarean births one of the top-8 principal diagnoses with a rapidly increasing length of stay.[18] Generally, cesarean birth is twice as costly to commercial insurance payers and Medicaid as vaginal birth, although there is also a significant difference in reimbursement to hospitals and providers between these 2 major payers.[19] For both vaginal and cesarean births, commercial insurance company reimbursement is approximately 100% more than Medicaid.[19] For example, in 2010, commercial insurance companies paid an average of $27 866 and Medicaid paid an average of $13 590 for cesarean birth as compared with $18 329 and $9131, respectively, for vaginal birth.[19] These payments include reimbursements to hospitals, maternity care providers, anesthesia providers, and radiology/imaging, pharmacy, and laboratory services; however, they are heavily concentrated on the intrapartum hospital stay.[19] Similar data were available for commercial insurance company payments in 2004. Of note, the 2010 commercial insurance reimbursement payments were 50% higher than those in 2004, although that represents only a 6-year time frame.[19] Data for Medicaid reimbursement payments with this level of detail are not available for

2004 to provide a parallel comparison[19]; however, these payments have also increased significantly.

Maternal morbidity and mortality risks

The costs of cesarean births are not solely economic; patient morbidity also is significant. When compared with vaginal birth, women having cesarean birth are at an increased risk for a variety of complications including a longer hospital stay, more pain and fatigue, a slower return to normal activities, delayed breastfeeding and breast-feeding problems, anesthesia complications, postpartum hemorrhage, wound infections, deep vein thrombosis, and maternal death.[20–22] These risks are exacerbated with subsequent cesarean births due in part to more placental abnormalities and surgical challenges.[5,23] They include cesarean hysterectomy, blood transfusions, adhesions, surgical injuries, infection, wound complications, bowel injury and obstruction, and delayed interval from incision to birth.[23–29] There is a dose-response relationship between the number of cesarean births and maternal morbidity; the more cesarean births, the greater the risk of morbidity, especially for women with 3 or more cesarean births.[26,30]

As the availability of hospitals and providers willing to support care for women having a trial of labor after a previous cesarean birth has declined, approximately 90% of women who have primary cesarean birth will have a subsequent cesarean birth in their next pregnancy.[31] A major implication of the rising primary cesarean birth rate is therefore the resultant rise in repeat cesarean births with all of their associated maternal morbidity and risk of mortality.[5] Efforts to understand why so many low-risk women are having primary cesarean births are critical to minimize maternal health risks now and in the future.

EVIDENCE ON LABOR PROGRESS OF CONTEMPORARY HEALTHY WOMEN

Changes in clinical practice and the obstetric population

For the last several decades, the Friedman[32,33] labor curve has served as the clinicians' guide to assessing adequacy of labor progress. Clinical judgments and decision making regarding important issues such as the likelihood of vaginal birth were often based on whether a graphic representation of a woman's cervical dilation over time was consistent with expectations based on the Friedman curve. Friedman[32,33] made substantial contributions to what is known about the progress of labor; however, there have been many changes in clinical practice since his original data were published. In a study comparing women in spontaneous labor, with a single vertex baby, who labored approximately 50 years ago (sample of 54 390 births in 12 hospitals from 1959 to 1965; Collaborative Perinatal Project) with more contemporary women, also in spontaneous labor with a single vertex baby (sample of 228 668 births in 19 hospitals from 2002 to 2008; Consortium on Safe Labor [CSL]), contemporary women were older (26.8 vs 24.1 years) and heavier (body mass index [BMI] 29.9 vs 26.34 kg/m^2), had higher epidural rates (55% vs 4%), and had higher oxytocin use (31% vs 12%).[2] These differences translated into longer first-stage labors than those 50 years ago: +2.6 hours in nulliparous women and +2.0 hours in multiparous women, even when adjusting for maternal and pregnancy characteristics such as maternal age, race, BMI at birth, gestational age, spontaneous rupture of membranes, and birth weight.[2] Newborn babies of the contemporary labor group were an average of 99 g bigger, although their mothers gave birth nearly 5 days earlier than the women 50 years ago.[2] There was also a 4 times greater cesarean birth rate (12% vs 3%).[2] Researchers concluded that prolonged labor is mostly due to changes in practice patterns and that the increase in cesarean births was likely related to cesarean initiation before women reached 6 cm of cervical dilation.[2,34]

According to a recent study of 228 668 women in 19 hospitals in the United States from 2002 to 2008 (CSL), the most common reasons for cesarean births were failure to progress/cephalopelvic disproportion (47.1%), followed by "nonreassuring" fetal heart rate (FHR) pattern (27.3%).[35] Others have noted similar findings that approximately one-third to one-half of cesarean births are the result of a diagnosis of labor dystocia or failure to progress.[16,36] However, it is well-known, based on numerous studies that many women with this diagnosis never actually achieve active labor.[4,36]

Active labor likely begins at 6 cm

Traditionally, the beginning of active labor has been defined as 4 cm of cervical dilation.[32,33] Critical evaluation of more recent data suggests that active labor begins at 6 cm rather than 4 cm.[4] Using the CSL sample of 19 US hospitals, data from 62 415 women with a single vertex fetus at term in spontaneous labor that resulted in a vaginal birth and a normal perinatal outcome were analyzed to determine labor patterns.[34] They found that spontaneous labor may take more than 6 hours to progress from 4 to 5 cm and more than 3 hours to progress from 5 to 6 cm for both nulliparous and multiparous women.[34] These time frames for cervical dilation and progress from 4 to 6 cm are much

slower than what has been described previously in the literature and have significant implications for clinical practice.[34] They concluded that allowing labor to continue for a longer period before women reach 6 cm of cervical dilation could reduce rates of both primary and repeat cesarean births in the United States.[34] Harper et al[1] found that the same strategies for allowing a slower progression up to 6 cm were applicable to women having induction of labor, based on an evaluation of the labors of 5388 women over a 4-year period in one perinatal center. They advocated careful consideration in applying the diagnosis of failed induction before 6 cm.

The data from Harper et al[1] are quite valuable in highlighting what time frames can be expected for spontaneous, augmented, and induced labor in nulliparous and multiparous women. Table 1 summarizes the range of normal labor progress for nulliparous women, comparing the 5th and 95th percentile ranges of normal for spontaneous, induced, and augmented labor in a contemporary setting.[1]

Similar data were reported for multiparous women.[1] It is also important to consider that labor proceeds more slowly as BMI increases; thus, labor management may be modified to allow more time to progress for women who are obese.[37] The key issue is recognizing that not all women will progress according to the mean and those who are slower than average may still be considered normal. As the upper limits represent the 95th percentile, this will be a small number of women. However, for these women who may need more time to progress to achieve vaginal birth, avoiding the risk of morbidity related to cesarean birth is worth the wait as long as the fetus is tolerating labor.

More than a decade ago, Rouse et al[38,39] found that applying a labor protocol that included extended time frames for latent- and active-phase labor and use of oxytocin to augment stalled labor was helpful in avoiding failed labor diagnoses and enhancing the likelihood of vaginal birth. They prospectively tested the efficacy and safety of a labor management protocol and were able to see success at minimizing cesarean birth for active-phase labor arrest.[38,39] These early findings were helpful in promoting a reconsideration of arbitrary time limits on various phases of labor and have been confirmed and supported by more recent studies.

Labor management recommendations from experts

In 2012, NICHD, SMFM, and ACOG convened a workshop of perinatal experts to discuss potential solutions to minimize risk of primary cesarean birth.[4] A review of available evidence of possible contributing factors to primary cesarean birth was conducted. Summaries of potentially modifiable obstetric, maternal, and fetal indications were offered. Each indication was qualified on the basis of the accuracy of its diagnostic criteria and potential effect on prevention of the first cesarean birth. Failed induction and arrest of labor were identified as having a potentially significant effect on primary cesarean birth and as obstetric factors that could be modified.[4] Advice on modification of these factors was offered in the form of algorithms for labor management. Fetal factors with a significant effect on primary cesarean birth rates were noted as malpresentation and "nonreassuring" antepartum or intrapartum fetal monitoring.[4] Education for caregivers related to appropriate management of FHR patterns was recommended as a preventive strategy. Obesity was discussed as a potentially modifiable maternal factor; however, suggestions for weight loss preconception and appropriate weight gain in pregnancy come too late to remedy obesity as a presenting condition intrapartum.[4]

The algorithms for management of spontaneous labor and induced labor were based on the most recent data about time frames that reflect normal labor

Table 1. **Range of labor progress within normal limits for nulliparous women based on type of labor; median (5th percentile, 95th percentile)[a]**

Cervical dilation, cm	Spontaneous (h) (5th, 95th percentiles)	Induction (h) (5th, 95th percentiles)	Augmented (h) (5th, 95th percentiles)
3-10	4.2 (1.3, 13.1)	6.9 (2.0, 24.9)	6.6 (2.0, 23.6)
3-4	0.4 (0.1, 2.3)	1.4 (0.2, 8.1)	1.2 (0.2, 6.8)
4-5	0.5 (0.1, 2.7)	1.3 (.02, 6.8)	1.4 (.03, 7.6)
5-6	0.4 (0.06, 2.7)	0.6 (0.1, 4.3)	0.7 (0.1, 4.9)
6-7	0.3 (0.03, 2.1)	0.4 (0.05, 2.8)	0.5 (0.06, 3.9)
7-8	0.3 (0.04, 1.7)	0.2 (0.03, 1.5)	0.3 (0.05, 2.2)
8-9	0.2 (0.03, 1.3)	0.2 (0.03, 1.3)	0.3 (0.03, 2.0)
9-10	0.3 (0.04, 1.8)	0.3 (0.04, 1.9)	0.3 (0.05, 2.4)

[a] $N = 5388$ women in 1 hospital from 2004 to 2008 who reached second-stage labor. Compiled from data presented in Harper et al.[1]

progress in contemporary obstetric practice from the CSL project[4] (see Figures 2 and 3). Definitions of failed induction and arrest of labor disorders were incorporated into the recommendations. For failed induction of labor, suggested criteria included the failure to generate regular (eg, every 3 minutes) contractions and cervical change after at least 24 hours of oxytocin administration, with artificial membrane rupture if feasible.[4] First-stage labor arrest criteria were described as no progress after cervical dilation of 6 cm or greater with membrane rupture and no cervical change for 4 hours or more of adequate contractions (eg, >200 Montevideo units) or 6 hours or more if contractions were inadequate.[4]

Second-stage arrest definitions were based on parity and regional anesthesia. Progress was defined as descent and/or rotation. The time frames suggested for second-stage labor arrest were no progress for 4 hours or more in nulliparous women with an epidural, 3 hours or more in nulliparous women without an epidural, 3 hours or more in multiparous women with an epidural, or 2 hours or more in multiparous women without an epidural.[4] These time frames seem reasonable based on the use of passive fetal descent for women with regional anesthesia who may not feel an urge to push immediately upon reaching 10 cm of cervical dilation.

The general theme of the report was encouragement for patience and a reconsideration of what constitutes normal labor progress for nulliparous women. Measures that could be used to evaluate clinical practice changes were provided, including elective cesarean births, elective labor induction, and labor arrest or failed induction diagnosed without meeting accepted criteria as outlined in the report.[4] Application of the recommendations in the report should be accompanied by measurement. Collecting data regarding these recommended maternal clinical factors, as well as neonatal outcomes, is useful so that potential gains in minimizing maternal risks associated with cesarean birth can be quantified and any possible unintended consequences can be identified in a timely manner. Since adverse outcomes are unusual, using a composite newborn outcome measure such as Unexpected Newborn Complications, which is currently known as Healthy Term Newborn,[40] may be most useful.

Maintaining fetal well-being

Supporting a woman in giving birth vaginally within the upper normal limits of labor duration must be in the context of a well fetus. Most fetuses (84%) will demonstrate FHR pattern characteristics that are both normal (category I) and indeterminate (category II) over the course of labor.[41] Fortunately, abnormal (category III) FHR patterns are rare (0.1%). On average, the duration of category I is about 78% of labor, category II 22%, and category III 0.004%.[41] Ideally, if the FHR pattern is category II, there is moderate variability and/or accelerations to support the presumption of a nonacidotic fetus. However, the wide range of clinical implications

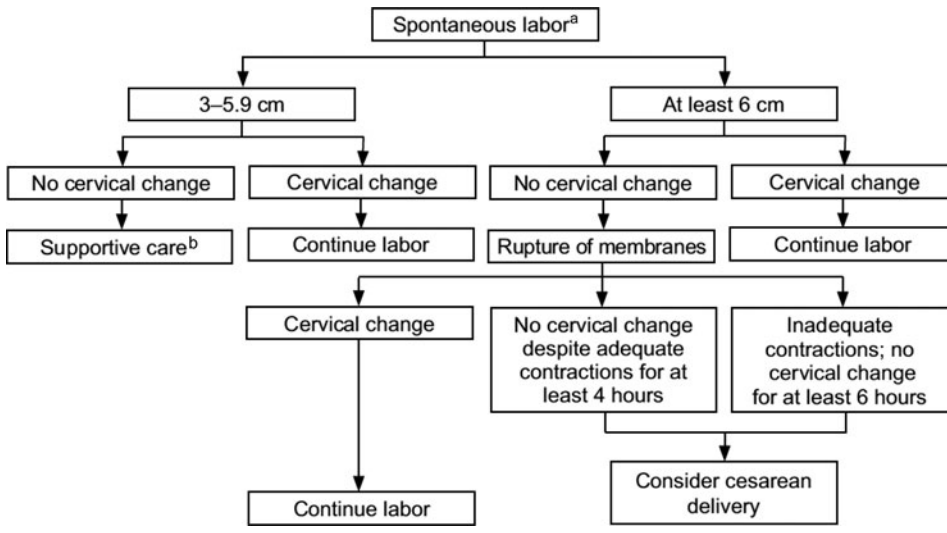

Figure 2. Algorithm for spontaneous labor. From Spong et al.[4] Reprinted with permission. [a]Consider outpatient management of uncomplicated labor until at least 3 cm dilated or fetal membrane rupture occurs. [b]Continued observation in latent phase; augmentation as indicated. Discharge may be appropriate if labor subsides, membranes remain intact, and maternal and fetal status remains stable.

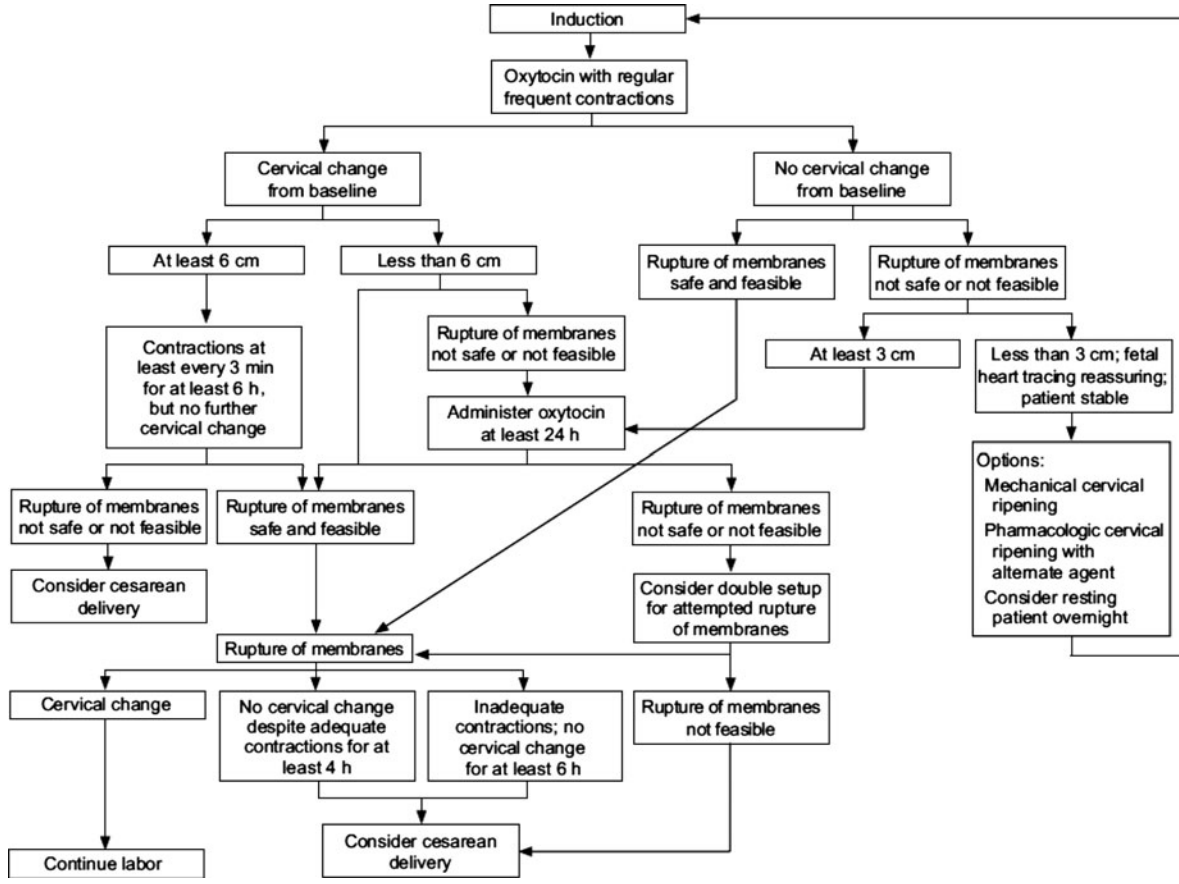

Figure 3. Algorithm for induction of labor. From Spong et al.[4] Reprinted with permission.

associated with the various types of FHR patterns within category II and the imprecise nature of this category as it relates to fetal well-being can make it challenging to use it to make clinical decisions during labor. The longer the FHR remains in category II, especially during the last 2 hours prior to birth, the greater the risk of neonatal morbidity.[41] For example, if more than 50% of the time was spent in category II in the last 2 hours prior to birth, there is a greater likelihood of an Apgar score less than 7 at 5 minutes of life and admission to the neonatal intensive care unit.[41] On the basis of a review of current evidence on labor progress and fetal status, Clark et al[42] proposed a management algorithm for category II FHR tracings during labor (see Figure 4). The practical approach outlined in the algorithm and discussed in detail in the article encourages careful consideration of labor progress and the likelihood of vaginal birth within a time frame that supports birth of a healthy baby when making labor management decisions.[42] Application of intrauterine resuscitation measures as described by ACOG[43] are recommended on the basis of the specific features of the FHR pattern. These interventions may include some of the following: lateral maternal repositioning, an intravenous fluid bolus, maternal oxygen administration at 10 L per nonrebreather face mask, correction of maternal hypotension, reduction of uterine activity, amnioinfusion in first-stage labor for recurrent variable decelerations that do not resolve with position change, and modification of maternal pushing efforts in second-stage labor. Careful fetal surveillance and initiation of intrauterine resuscitation measures in a timely manner can help avoid a cesarean birth that is based on concern for fetal status.

PROMOTING CHANGES IN PRACTICE

Being knowledgeable about the evidence

Incorporating this recent evidence into clinical practice has significant implications related to the diagnoses that often lead to cesarean birth including failed induction of labor, first-stage labor arrest, failure to progress in labor, cephalopelvic disproportion, and labor dystocia. Allowing more time for progression in early latent-phase labor and cervical dilation from 4 to 6 cm may decrease the risk of cesarean birth for both nulliparous and

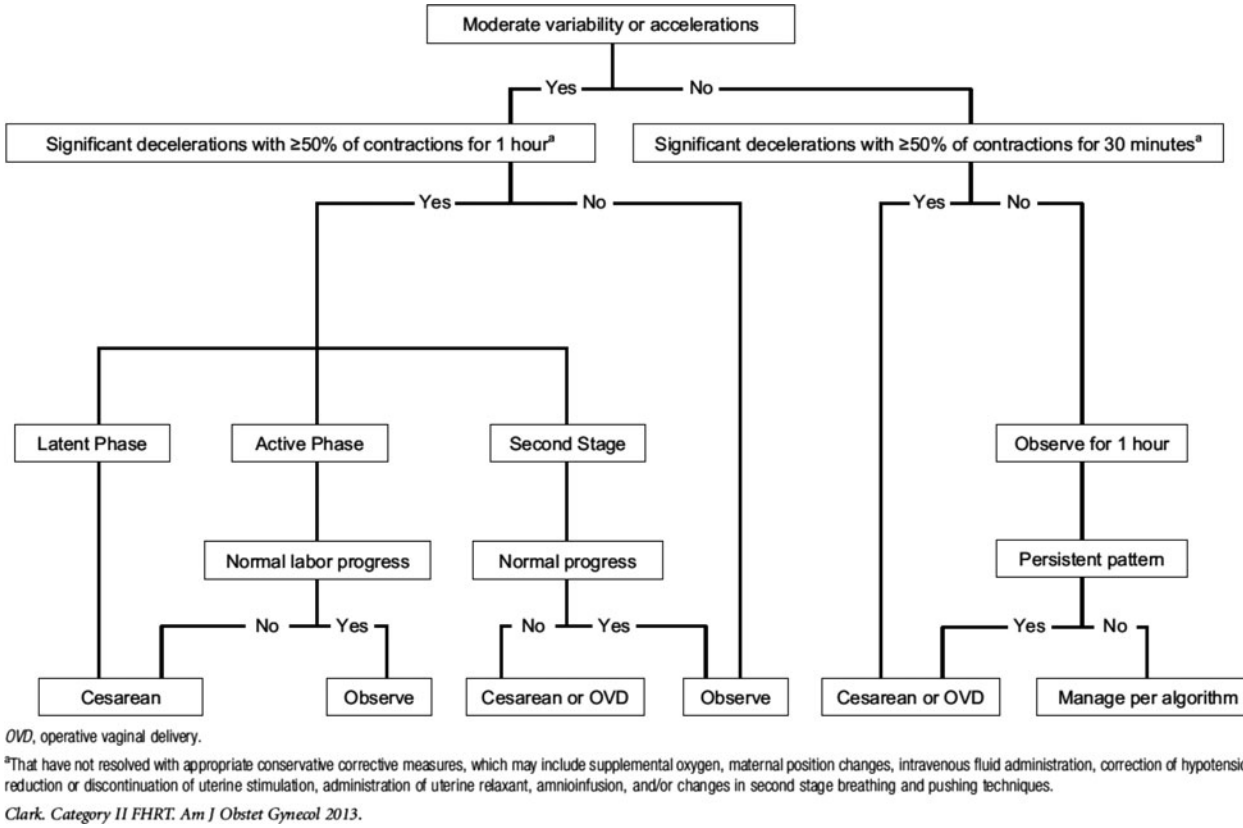

Figure 4. Algorithm for management of category II (indeterminate) fetal heart rate tracings. From Clark et al.[42] Reprinted with permission.

multiparous women. Changing labor management practices for healthy women offers significant opportunity for improvement and to promote safer care for mothers and babies. All clinicians caring for women during labor and birth should review the evidence and subsequent recommendations for labor management presented by the expert group convened by NICHD and cosponsored by ACOG and SMFM.[4]

Public reporting and consumer awareness

Perhaps, measurement and public reporting of institution and practitioner cesarean birth rates will promote change. In 2008, the National Quality Forum recommended measuring the rate of cesarean birth for low-risk nulliparous women at term with a singleton vertex fetus.[44] In 2009, The Joint Commission (TJC) adopted this quality measure as part of its perinatal care measure set.[45] Until now, TJC's perinatal measure set has had relatively low participation; however, starting in January 2014, all TJC-accredited hospitals with a perinatal service and birth volume of 1100 births or more annually are required to submit these data. Consumers may choose to avoid hospitals with high rates of cesarean births for low-risk healthy women when deciding among options for where to give birth.

Patient education

Encouraging and supporting a knowledgeable patient offer further opportunity for change. The Choosing Wisely campaign by the ACOG[46] advising women to await spontaneous labor is a step in the right direction. The American College of Nurse-Midwives has long advocated this approach.[47] Childbirth Connection,[48] a consumer advocacy organization for childbearing women, has quality educational materials available on its Web site, with information about the benefits of avoiding unnecessary interventions, as does Lamaze International.[49] Truly informed decision making by a pregnant woman is critical. Directing women to any of these resources may be helpful in making a difference in their understanding of labor, childbirth options, and associated potential risks and benefits.

SUMMARY

By acknowledging that women progressing within values on both ends of the spectrum of expected labor

time frames may be considered normal and a vaginal birth of a vigorous baby can often be anticipated, these most recent data discussed here support a change in practice: allowing more time to achieve vaginal birth in the context of a healthy mother and a healthy baby. Failure to progress or other associated diagnoses such as protraction and arrest disorders should be based on upper limits of normal rather than averages. Recognizing that many women will have labor within normal limits, even if longer than average, requires an updated knowledge of the evidence and a willingness to be patient. Patience is underrated as a patient safety strategy. Avoiding unnecessary interventions by careful watching and waiting deserves more attention.

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