

A Critical Review of Labor and Birth Care

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A critical review of the literature regarding important aspects of labor and delivery was conducted by members of the Obstetrical Interest Group of the North American Primary Care Research Group using computerized searches, personal communication, and literature exchange between group members. Each written topic summary was carefully reviewed by a second group member, and a consensus was reached regarding conclusions and recommendations by the group. The topics include family involvement, comfort measures, fetal heart rate monitoring, labor augmentation, birth positions, and episiotomies. Each topic summary is pre-

ceded by conclusions and recommendations given in the order of least invasive to most invasive of the woman in labor. The strength of these conclusions and recommendations is based on the amount and type of supportive data in the literature and is indicated by one to three stars preceding that statement. One-star conclusions are not well supported in the literature but reflect a family practice style and were reached through consensus from the group. Three-star conclusions are supported by data from clinical trials.

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Family-centered birth care has become the stated goal of many hospital maternity units, care providers, and their professional associations.^{1,2} The operational elements of such care include preparation and education of the parturient and family, presence of a significant other or sometimes the extended family during and/or after the birth, relaxed surroundings offering flexibility to the woman giving birth, early parent-infant contact and putting the child and the mother in the same room, promotion of breast-feeding, and organization of nursing care around the family unit.²⁻⁵ The goals of family-centered care include safe childbirth for the mother and the baby, enhancement of the childbearing woman's connection with social supports, including the health care system,

facilitation of parent-infant bonding, and empowerment (enhanced status and autonomy) of the woman giving birth.⁵⁻⁶

Providers of obstetric care who advocate a family-centered approach must critically assess the effects of each medical practice or procedure on the childbearing family's comfort and sense of mastery, as well as on their safety. Aspects of care for which safety benefits are small or unproven should remain subject to the choices and preferences of the woman giving birth. Furthermore, a particular intervention cannot be assessed in isolation but must be evaluated as part of a system, with changes in one aspect affecting the whole process.⁷

The purpose of this paper was to critically review aspects of low-risk labor and birth. The panel that prepared this review are members of the Obstetrical Interest Group of the North American Primary Care Research Group (NAPCRG). NAPCRG is an organization for research activities associated with family medicine. Its mission is to improve the health of individuals, families, and communities through the development and dissemination of new knowledge that meets the needs of people as they relate to primary care practice, organization, and education. In keeping with this mission, the Obstetrical Interest Group, composed of academic physicians, com-

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munity physicians, and allied health professionals, chose to complete this review as its first collaborative effort. Each topic area was written by one member of the committee and subject to a critical review by a second member. The entire document was then edited and submitted back to the group for review and establishment of a consensus. The literature review was accomplished using computer searches and manuscript exchange by members of the committee. For many of the sections presented below, there was great difficulty in reaching the recommendations that are given owing to the lack of power of many studies (often resulting from small numbers), problems with selection bias and loss to follow-up, and the use of proxy measures such as a request for medication to reflect pain intensity or the use of fetal monitor tracings to represent fetal distress.

Recognizing these limitations, the authors rated the recommendations and conclusions put forth in this study for validity, and added to the topic summaries a brief review of the supporting literature. Each recommendation is preceded by one, two, or three stars. The single star refers to those policies or procedures that have been judged by this panel to be useful but are not based on scientific data because of a lack of available information; they might therefore be determined by a woman's preference. Two stars indicates recommendations derived from a few small clinical trials or case-control studies and case series. Three stars designates a recommendation well supported by the existing literature. The recommendations are ordered from least invasive to most invasive, in keeping with the family practice perspective on limiting the use of technology where such practices do not confer clear benefit.

Family Involvement

Recommendations and Conclusions

- ☆☆1. Continuous support throughout labor should be available to women. For women without other apparent means of social support, continuous support during labor and birth has a positive effect on birth outcomes. The effect of continuous support for women with family support and the best choice of provider for that support are unclear. Partners should be encouraged to attend the birth to provide support.
- ☆☆2. The father's presence at the birth strongly increases the mother's satisfaction with the birthing experience. No evidence of harm exists from allowing fathers to be actively

involved in labor and delivery.

- ☆3. The scant existing evidence indicates that there is no short-term harm to the sibling child who observes the birth, and suggests the possibility of an increase in nurturing behaviors. No long-term study of the impact on the observing child has been reported.

Continuous Support

The most compelling research on the importance of continuous support during the perinatal period was done by Sosa and colleagues in Guatemala.^{8,9} Women were randomized to either the intervention group, who received supportive care from admission to delivery from a *doula* (an untrained lay person), or to the control group, who were not provided with continuous support. Significant findings for the intervention group included a marked decrease in length of time from admission to delivery (8.7 hours vs 19.3 hours, $P < .001$); fewer perinatal complications, including cesarean sections (7% vs 17%, $P < .01$); and lower rates of oxytocin augmentation (2% vs 13%, $P < .001$). A recent replication of the "doula study" was performed in Houston on a patient population who routinely labored without family support.¹⁰⁻¹² Doula-supported births were significantly less likely to result in cesarean section (8% vs 18%, $P = .004$), forceps delivery (8.2% vs 26.3%, $P < .001$), or use of epidural anesthetic (7.8% vs 55.3%, $P < .001$).¹² In addition, significantly fewer infants born of doula-supported deliveries required prolonged hospital stay or sepsis evaluation.¹²

When family support already exists, the impact of continuous labor support by a health care professional is less clear. In a low-risk obstetric population in Toronto, Canada, Hodnett and Osborn¹³ demonstrated decreased use of pain medication, fewer episiotomies, and a greater perception of control in patients with continuous professional support during labor.

Father's Impact

Mercer et al,¹⁴ in a sample of 294 postpartum women, assessed both prenatal and intrapartum factors to determine their influence on the perception of labor and delivery. The authors confirmed that women with a partner present had a more positive perception of the birth experience. When all the variables were entered into a stepwise multiple regression statistical model, emotional support from the mate during parturition entered the model first and accounted for the largest proportion of the variance. Klein et al¹⁵ observed couples during labor and found that fathers were significantly more likely than nurses to be present in the labor room, to offer a comforting item, and to touch their partner. Mothers rated

the father's presence as significantly more helpful than that of the nurses.

Hennedorn and Cogan¹⁶ compared the impact of fathers who attended labor and birth with that of fathers who attended only the first stage of labor. When fathers were involved in the entire birth process, women reported less pain, received less medication, and the couple reported more positive experiences about the birth than the women whose husbands participated in the first part of labor only. These findings may be confounded, however, by preexisting differences between the two groups of fathers. Similar findings were reported by Bennett et al,¹⁷ who found partner support to be correlated with pain-relief methods; the higher the support, the more likely women were to use massage and verbal support and the less likely they were to have an epidural anesthetic.

Sibling Presence

In a descriptive study of 43 births attended by siblings,¹⁸ 88% of the parents reported their presence as being an unqualified success. These were, of course, self-selected families. Lumley¹⁹ reported no significant difference in hostile, affectionate, or regressive behaviors in a group of 22 preschool children 2 months after they had observed the birth of a sibling as compared with a group of children whose first introduction to the baby had occurred a short time after the birth; both groups had received the same birth preparation. In a similar study, DelGiudice²⁰ found no difference in evidences of sibling jealousy (including regression, temper tantrums, harsh physical play, and sleep problems) between two groups of children, both of which had attended sibling preparation but only one of which had attended the birth. There was a significant increase in caretaking and mothering behaviors (by parental report) in the birth-attending group. No group was studied in which the children did not receive sibling preparation, and preexisting differences in parenting or sibling temperament were not examined. The possibility of reporting bias to justify the sibling's birth attendance exists.

Comfort Measures

Recommendations and Conclusions

- ☆1. All patients should receive basic education in physiology, expected changes and sensations of labor, relaxation and breathing techniques, and medication options in a nonjudgmental fashion.
- ☆2. The presence of a full-time support person

appears to have positive effects on a woman's pain tolerance and perceived comfort during labor.

- ☆☆3. Nitrous oxide is of uncertain benefit. Obtaining adequate analgesia may require doses that risk aspiration. A person experienced in its use should be in attendance.
- ☆☆4. Narcotic analgesics are easily administered and provide good analgesia. Excessive effects on the mother or infant may be partially reversed by naloxone. It is desirable to use a narcotic that does not have active metabolites and to administer the narcotic intravenously.
- ☆☆☆5. Paracervical anesthesia is easily administered and results in good analgesia, but should be administered in a very shallow injection. Transient fetal bradycardia will be seen in a small number of patients and must be differentiated from other causes of bradycardia. This block should be avoided in cases where there is fetal compromise.
- ☆☆☆6. Epidural anesthesia may be used when the services of an individual skilled in the technique are continuously available. When properly administered, epidural anesthesia provides excellent analgesia, although it is associated with prolonged labor and increased use of forceps. Abnormal fetal heart tracing due to epidural blockade must be differentiated from cord compression or hypoxic etiologies.

Prenatal Education

The techniques of relaxation and positive imagery should be mastered by the patient during the prenatal period in order to most effectively use psychoprophylaxis in the management of labor pain. A program of birth education that includes teaching relaxation skills to the mother and training her to focus on the positive outcome of the delivery is more likely to be successful than one that teaches only breathing techniques.²¹ As qualifications of instructors vary greatly,²² physicians should carefully investigate the local childbirth education programs for content and quality of instructor. Melzack et al²³ found that the labor pain reported by women who received prenatal education classes varied in intensity according to the identity of the individual instructor. One recent study of a group of women who were randomized to receive labor support from a lay midwife (who provided support to couples from the onset of early labor at home until 1 hour postdelivery) found that significantly fewer women in the support group required medication. Furthermore,

Table 1. Benefits and Risks of Comfort Measures in Labor

Type	Benefits	Risks
Nonpharmacologic Education and psychoprophylaxis	Safe Positive imagery best ²⁰	Variable pain relief
Nitrous oxide	Shortens labor ²⁵	Inadvertent overdose risks aspiration ²⁴ Less pain relief than lumbar epidural ²⁵
Meperidine (Demerol) and other narcotics	Good pain relief Easily administered (IV route more predictable ²⁶)	Sedation or respiratory depression of mother and infant Decreased Apgar scores and activity of neonate ²⁷⁻²⁹ Concentrated in an acidotic fetus ³³
Lumbar epidural anesthesia	Excellent pain relief	Requires skilled provider ^{24,34,35} Maternal hypotension ^{24,36} Prolonged labor ^{24,25} Abnormal presentation requiring forceps ^{25,37} Increased augmentation ³⁷⁻³⁹ Abnormal fetal tracing ⁴⁰⁻⁴² Maternal urinary retention ³⁷ Maternal paresthesia/motor dysfunction ⁴³
Paracervical anesthesia	Easily administered ²⁴ Fetal bradycardia seen is likely not fetal distress ⁴⁵ Analgesia superior to and safer than meperidine ⁴⁴ Retain urge to push ⁴⁵	Fetal bradycardia 1.9%–3.8% if a shallow injection ^{44,47,48} Fetal bradycardia 11.3%–15% if deeper injection ^{46,49} Perineum not anesthetized

these women remembered more physical comfort measures and greater emotional support compared with women in the control group for which standard care was provided.²⁴ Data on the effects of continuous labor support are reviewed in the preceding section. Expectations should be discussed, as women who expect that these "natural methods," when performed correctly, will prevent all pain and the need for drugs may feel guilty and inadequate if the pain is greater than expected.²⁵ While management of fear and anxiety may increase the tolerance for the pain of labor,²⁶ medicine may still be required in some patients owing to prolonged labor, malpresentation, or other causes. Table 1 is a summary of the risks and benefits of comfort measures in labor.

Nitrous Oxide

Inhalation of a gaseous analgesic is commonly employed in some areas to relieve the pain of labor.²⁵ A nitrous oxide and oxygen mixture is easy to obtain and appears relatively safe. In addition to lessening discomfort, nitrous oxide may shorten labor.²⁶ Unfortunately, overdose may occur because pregnancy lowers the concentration required for its intended effect.²⁵ In addition to the difficulty in determining the correct dose, the pain relief is less than that obtained with lumbar epidural anesthesia.²⁶

Analgesia

Narcotic analgesics are very widely used in labor. The most commonly reported individual agent is meperidine

(Demerol), which is easily administered parenterally. The effects of the drug are more predictable when given intravenously rather than intramuscularly.²⁷ Sedation and respiratory depression of the mother and neonate may follow. Infants exposed to meperidine have lower Apgar scores and decreased activity compared with controls.²⁸⁻³⁰ Another concern is that a first-order metabolite is pharmacologically active and only partially reversed by naloxone.³¹⁻³³ This is not true of other available medications (eg, butorphanol). Also, all narcotics are weak bases and are therefore concentrated in an acidotic fetus.³⁴

Epidural Anesthesia

Those advocating epidural anesthesia recommend continuous monitoring of the patient by an anesthesiologist.^{25,35,36} Although the correctly applied lumbar epidural block will provide excellent pain relief, an inadvertent spinal block with sudden hypotension may occur if the dura is penetrated.^{25,37} Epidural anesthesia is likely to prolong labor^{25,26} and result in higher rates of instrument-assisted delivery,^{26,38} increased use of oxytocin,³⁸⁻⁴⁰ and possibly increased cesarean-section rate.⁴⁰ Up to 47% of fetal heart rate tracings may be abnormal after epidural block.⁴¹⁻⁴³ Late side effects may include maternal urinary retention,³⁸ paresthesias, and motor dysfunctions greater than in a control group.⁴⁴

Paracervical Block

Paracervical block, though not currently practiced in many locations, is easily administered²⁵ and results in an analgesia that is superior to, and safer than, that given by parenteral meperidine.⁴⁵ Opponents of paracervical block cite case reports from the 1960s that associated fetal death with paracervical block. A review of 70,000 patients treated with paracervical block revealed that transient fetal bradycardia associated with the block did not indicate fetal distress.⁴⁶ LeFevre,⁴⁷ however, found a significantly higher incidence of postparacervical fetal bradycardia when the fetal heart rate pattern had been abnormal before the block. He recommended restricting the use of paracervical blocks to patients with reassuring fetal heart rate patterns.

Depth of injection of paracervical block also affects the incidence of fetal bradycardia. A submucous application of local anesthetic results in bradycardia 1.9% to 3.8% of the time,^{45,48,49} while a deeper injection results in bradycardia in 11.3% to 15% of cases.^{47,50} Duration of the effect is between 60 and 90 minutes.^{45,48} The mother experiences no loss of the urge to push when the drug is appropriately administered.⁴⁶

If perineal anesthesia is deemed necessary before instrumental delivery or episiotomy, a pudendal or local perineal anesthetic may be placed.

Intrapartum Fetal Monitoring

Recommendations and Conclusions

- ☆☆1. Although electronic fetal monitoring (EFM) has become generally accepted as standard care, routine EFM has not been shown to improve perinatal outcomes.
- ☆☆2. An association between routine EFM and an increased frequency of cesarean section has been observed. Periodic regular auscultation of fetal heart rate is at least as effective as EFM in detecting fetal distress in otherwise low-risk women and promotes greater patient-provider contact. At this time, either method of fetal monitoring may be used.
- ☆3. Technology for fetal blood pH sampling is not universally available and has not yet been shown to improve perinatal outcome. The use of fetal blood pH sampling in cases of worrisome fetal heart rate patterns may help to reduce unnecessary instrumental or operative deliveries.

Intrapartum monitoring of the first stage of labor can involve periodic auscultation of fetal heart rate, electronic fetal monitoring, and fetal scalp blood pH sampling. Protocols for periodic auscultation most often include monitoring the fetal heart rate every 15 minutes during the first stage of labor and every 5 minutes during the second stage of labor following a contraction. The mode of monitoring is determined in part by the technology available, the attitude of the physician with regard to medicolegal concerns, the skills of the physician in using and interpreting this technology, the perceived risk status of the patient before the onset of labor, the occurrence of specific at-risk intrapartum events suggesting fetal distress (such as meconium staining upon rupture of membranes or preeclampsia) and the community standard of practice.

Electronic Fetal Monitoring

To date, eight randomized controlled clinical trials have been published that investigated the effectiveness of EFM. Four trials were conducted in high-risk populations. Havercamp et al⁵¹ compared patients randomly assigned to either intermittent auscultation or EFM with a fetal scalp electrode. While the comparability of the groups has been questioned,⁵² no difference in perinatal morbidity and mortality was found, whereas the rate of cesarean section for fetal distress was significantly greater in the EFM group. These authors repeated their study,⁵³ introducing a third group of infants who were monitored by EFM with optional fetal scalp pH sampling. While fetal scalp pH sampling reduced (but did not eliminate) the increased frequency of cesarean sections, no differences in perinatal morbidity or mortality were detected. More recently, the results of a multicenter trial comparing intermittent auscultation with EFM plus optional fetal scalp pH sampling in preterm labor reported no differences between groups in perinatal outcome or in the cesarean section rate.⁵⁴ A follow-up study of these infants at 18 months of age found no differences in mental or psychomotor development, with a significantly higher incidence of cerebral palsy in the electronically monitored group.⁵⁵

Three randomized controlled trials of EFM were conducted in low-risk populations.⁵⁶⁻⁵⁸ All clearly demonstrated no differences in neonatal outcome. One of these studies⁵⁸ did find a higher rate of neonatal seizures in the unmonitored group, but at 1 year of age, there was an equal number of major neurologic problems in each group. While the influence of EFM on the frequency of cesarean section was inconsistent, assisted deliveries (forceps) were more common in the continuously monitored group. Leveno et al⁵⁹ studied the effect of selective vs universal monitoring in a general population of women.

Higher perinatal mortality during the selective monitoring period was attributed to greater numbers of intrauterine deaths before admission. High cesarean section rates were noted during the universal monitoring period. More recently, McCusker et al⁶⁰ reported the results of a retrospective analysis of data from the 1980 National Natality Survey conducted by the National Center for Health Statistics. They found an association between EFM and higher cesarean section rates when they controlled for all risk factors for poor neonatal outcome. A lack of association of EFM with beneficial neonatal outcomes was attributed either to a true lack of effect or to selection bias.

Scalp Blood pH Sampling

Reliability of the interpretation of fetal heart rate patterns, even among experts, has been poor.⁶¹ The addition of fetal scalp blood pH sampling can be used to confirm conservative management of labor (reducing the false-positive rate) or can validate the need to intervene (reducing the false-negative rate). Nevertheless, no studies have demonstrated that the addition of fetal scalp blood pH sampling increases agreement regarding the management of labor.

Labor Augmentation

Recommendations and Conclusions

- ☆1. Nonpharmacologic methods of labor augmentation (including breast stimulation, amniotomy, and the use of labor positions and ambulation) may be used but are not well studied.
- ☆☆2. Amniotomy performed before 6-cm dilatation shortens labor but may be associated with reduced cord pH. Individualized use of this procedure is indicated.
- ☆☆☆3. Labor augmentation might be considered for a cervical dilatation rate of less than 1.2 cm per hour for nulliparous women and less than 1.5 cm per hour for multiparous women. Labor augmentation should be considered for a cervical dilatation rate of less than 0.75 cm per hour in the active phase of labor (4 to 10 cm dilatation). This latter rate of dilatation falls below the 10th percentile for normal spontaneous labor.

Dysfunctional Labor

The diagnosis of dysfunctional labor is usually made by comparing a graphic representation of the progress of

labor to a standardized labor curve or by calculating the rate of cervical dilatation. Various authors define different categories of abnormal labor, but all are abnormalities of dilatation or descent and all may be amenable to treatment with oxytocin.⁶² The majority of women dilating less than 0.75 cm per hour have uterine activity levels below the 10th percentile for normal spontaneous labor.⁶³ Friedman⁶⁴ recommends initiating pharmacologic augmentation for nulliparous women dilating less than 1.2 cm per hour and for multiparous women dilating less than 1.5 cm per hour.

Risks of Oxytocin

The use of oxytocin to augment labor is not without risk and should be carefully considered. Unnecessary intervention with oxytocin may lead to excessive use of intravenous infusions, fetal and uterine monitors, analgesia, and recumbent position with a potential increase in maternal and infant morbidity and increased risk of cesarean birth. Contraindications to the use of oxytocin are controversial^{65,66} but include nonvertex presentation, vertical uterine scar, multiple gestation, fetal distress, maternal hemorrhage, and grand multiparity. Caution should be used if there is a history of uterine trauma or infection, or if the estimated fetal weight is more than 4500 g.⁶⁷

Administration of Oxytocin

Until recently, protocols for the induction or augmentation of labor called for rapid increases in the oxytocin dosage at 15-minute intervals until an adequate contraction pattern was obtained. Newer studies show a possible higher rate of uterine hyperstimulation manifested by fetal distress with this protocol.^{68,69} Studies of the *in vivo* activity of oxytocin have led to recommendations for lower dose protocols with longer intervals between dose increments.⁷⁰⁻⁷² These studies,^{63,69} however, did not find any difference in outcome of neonates who had oxytocin stopped or decreased for hyperstimulation or fetal distress. Because of the risk of fetal distress, continuous monitoring of the fetal heart rate has been recommended by the American College of Obstetricians and Gynecologists.⁷³ The incidence of uterine hypercontractility and fetal distress can be decreased with 30-minute instead of 15-minute intervals.

The large O'Driscoll series⁶² and several recent prospective randomized trials⁷⁴⁻⁷⁸ support the concept of "active management" of labor. Allowing a dysfunctional labor to continue may result in patient exhaustion, increased risk of infection, and also an increased risk of cesarean birth. When oxytocin is administered, levels of uterine activity are corrected to normal in approximately 75% of women with infusion rates of 8 mU per minute⁶⁴ or less, although the greatest net response is achieved

with doses of 16 to 32 mU per minute.⁷⁹ With higher doses there is a trend toward shorter labors and a decrease in the cesarean birthrate, but numbers are inadequate to confirm this.⁸⁰ These doses are consistent with (but not identical to) those used in the large O'Driscoll studies of active management of labor, which maintained a stable cesarean birthrate of 5% without any increase in perinatal morbidity or mortality. Further studies of the group requiring infusion rates greater than 8 mU per minute are needed.

Breast Stimulation

Breast stimulation to augment labor is a traditional birthing technique used by lay midwives and birth attendants over the centuries in countries as far apart as Turkey and Indonesia. It has also been used by midwives in western societies, incorporated into body massage during labor.⁸¹ Breast stimulation will produce contractions earlier and more frequently than oxytocin, but with less intensity.^{82,83} The effectiveness of breast stimulation is not yet established by randomized controlled trials. Preliminary data from one trial suggest that, in low-risk women with indications for augmentation, 35% will proceed to normal delivery using breast stimulation (Curtis P, Resnick J, Evens S. Unpublished data, June 1985). In this study there was no increased risk to the fetus using breast stimulation in terms of hyperstimulation, fetal distress, meconium staining, or Apgar score. The protocol that appears to minimize the risk of fetal distress using breast stimulation is a cycle of 2 minutes of a manual or electric pump stimulation followed by 5 minutes of rest.

While induction of labor is beyond the scope of this paper, it should be noted that two randomized studies, using small numbers of patients, have shown that breast stimulation is effective in ripening the cervix and inducing labor.^{84,85} In addition, one randomized trial has evaluated the relative efficacy of oxytocin and amniotomy for induction of labor.⁸⁶ Amniotomy was found to be more effective than oxytocin. The mechanism was hypothesized to be an increase in prostaglandins following amniotomy.⁸⁷ However, this study may have been confounded by biased allocation of subjects.⁸⁸

Amniotomy

The results of two randomized trials^{89,90} suggest that amniotomy performed before 6-cm dilatation shortens labor by at least 2 hours. While both studies were small (121 total subjects), no adverse effects were observed. There are anecdotal reports of amniotomy resulting in increased fetal head compression and reduced cord pH.^{91,92} Thus, the potential advantages of being able to monitor the status of amniotic fluid and obtain more accurate recordings of the fetal heart rate need to be

weighed against these theoretical disadvantages and the potential for increased risk of cord prolapse if the fetal head is not well applied to the cervix. In the absence of studies examining this aspect of labor, an individualized approach is indicated.

Birth Positions

Recommendations and Conclusions

- ☆1. Women and their birth attendants should be educated in and encouraged to practice different birthing positions to allow for greater opportunities to achieve comfort, alleviate dystocia or malposition, and better adapt to individual needs.
- ☆☆☆2. There is good evidence that position change is useful in achieving good progress in labor, is well tolerated, and can be safely accomplished. Position change may be more important than a single "best" position.
- ☆3. The lateral Sims' delivery position may offer some advantages in fewer tears and better fetal oxygenation while maintaining good accessibility to the perineum for the birth attendant.
- ☆☆4. Supine positioning for labor and delivery may be poorly tolerated by some women and their fetuses. These situations should be anticipated and corrected through alternative positioning.

Labor and birthing positions chosen by laboring women or their attendants can be divided into those that are vertical or upright (including sitting, standing with or without walking, squatting, or upright kneeling) and those that are horizontal or recumbent (supine, prone, or quadruped, ie, squatting or kneeling with part of one's weight supported by the hands or elbows). The choice of position rests largely on social and cultural norms. Among the non-European cultures that have been studied, the upright position is followed by most.⁹³ Upright positions have been historically preferred over recumbent ones; the latter only became more popular in the 20th century with the expanding role of the birth attendant.^{94,95} When given freedom to assume any position desired without interference or instruction, Carlson et al⁹⁶ found a high degree of position change among the 80 women studied, with an average of 7.5 positions per woman. Ambulation was commonly practiced in the latent phase, extending into the active phase for multi-

paras. Russell⁹⁷ described the physiologic benefits of enlarging the transverse and anterior-posterior diameters of the outlet by 28% through squatting. Squatting, pelvic rocking, and position changes may also be useful in encouraging rotation of the fetal head to an anterior position or in the alleviation of dystocia.^{98,99} Descriptive case reports of delivery positions can be found on modified sitting,¹⁰⁰ sitting in a birthing chair,¹⁰¹ lateral Sims' position,¹⁰² and squatting.¹⁰³ Benefits suggested include good acceptance in all positions with few tears, and no episiotomies necessary in the lateral Sims' position according to one report.¹⁰² The only complications reported were perineal edema in the squatting or sitting position during some relatively long second-stage labors,^{103,104} and one report of greater mean blood loss and a higher rate of postpartum hemorrhage using a birthing chair.¹⁰⁵

The effect of position on uterine contractility and the duration of labor has been investigated in numerous randomized clinical trials¹⁰⁶⁻¹¹² ($n = 49$ to 375), three case series,¹¹³⁻¹¹⁵ and three studies in which the patient served as her own control, alternating between 2 positions.¹¹⁶⁻¹¹⁸ Three of the clinical trials^{106,109,119} showed no difference in uterine contractility and labor duration between the vertical and horizontal groups, whereas the remaining six clinical trials and all three case series reported differences, including shorter duration of labor,^{107,108,110,111,114,115} greater intensity (mm Hg) of contractions,^{108,110,111,120} and greater regularity of the labor pattern¹⁰⁸ in the vertical position. The differences in findings among the clinical trials and case series are likely due to the differences in measurement of labor duration, monitoring techniques (external vs internal), and the difficulty and effect on maternal anxiety of maintaining the experimental condition (forced vertical or horizontal positioning). The "crossover" studies by both Mendez-Bauer¹¹⁷ and Roberts¹¹⁸ and their co-workers avoided many of these problems by offering detailed descriptions of their protocols, specifying duration of the stages of labor, monitoring contractions through intrauterine catheters, and using limited experimental periods of 30 minutes. There were no complications attributed to the standing position, which was well tolerated, and the mean duration of labor (3 to 10 cm) among these nulliparous women was 3 hours, and 55 minutes. Roberts et al¹¹⁸ found that contractions that occurred while the woman was lying on her side were of greater intensity and efficiency (progress in cervical dilatation divided by the sum of the intensities of all contractions while in that position) compared with those that occurred while the woman was sitting, and of greater intensity compared with those that occurred while the woman was in a supine position. Further, the supine position was more

efficient when alternated with lying on the side, and lying on the side was more efficient when alternated with sitting.

The effect of position on fetal condition, cord artery or scalp capillary pH, tcPO₂, or fetal heart rate patterns were specifically investigated in two additional randomized clinical trials^{121,122} and three case series.¹²³⁻¹²⁵ From these studies one can conclude that certain women and their fetuses experience adverse hemodynamic changes when in a supine position, which are alleviated by lying on the side. Supporting evidence for this can be found through observations of supine maternal hypotension among small groups of women¹²⁶ and lower intervillous blood flow measured in the supine position using an intravenous xenon 133 method.¹²⁷ Doppler techniques during nonstress testing in 10 women, however, failed to demonstrate differences between left lateral and supine positions in uterine blood flow.¹²⁸ While physiologic benefits for the fetus from certain positions may be seen, it is not certain that these represent clinically significant measures.

The results of studies of position on maternal pain and comfort are inconsistent, especially when the proxy measure for pain is the use of analgesia. In the three clinical trials measuring the use of analgesia, one reported greater use when the patient was erect,¹⁰⁶ one found no difference,¹⁰⁹ and one found less use of analgesia when the patient was ambulatory.¹¹¹ Patient-reported pain in labor seemed consistently less with vertical positions.^{113,117,118} One study attempted to objectively measure pain using reflectoric hand pressure (pressure transmitted by a balloon in the patient's hand); less pressure was recorded, suggesting that the patient experienced less pain in the vertical position with the same intensity of labor.¹²⁰ Conclusions cannot be drawn from the evidence to date.

Episiotomies

Recommendations and Conclusions

- ☆☆☆1. Routine episiotomy for uncomplicated spontaneous vertex vaginal deliveries is not indicated.
- ☆☆2. When expeditious delivery is required, an episiotomy is likely to be useful.

Routine episiotomy continues to be recommended in standard obstetric texts,^{129,130} particularly for primiparas. Purported benefits from episiotomy include prevention of vaginal and perineal lacerations, prevention of pelvic relaxation, and prevention of damage to the newborn.

Thacker and Banta¹³¹ completed a comprehensive review of the literature from 1860 to 1980 on the benefits and risks of episiotomy and found no clearly defined evidence for its efficacy, particularly for its routine use. Data on vaginal lacerations were limited by inconsistent definitions of a laceration and the lack of a control group in most studies. Four studies comparing rates of laceration in women with episiotomies with rates in women without episiotomies found no consistent relationship, particularly with respect to laceration of the rectal sphincter. Data on pelvic relaxation were virtually absent, with three poorly controlled studies (two from 1935) producing conflicting results. Similarly, data in support of an episiotomy's beneficial effect for the infant were also absent. Limited data supported the contention that an episiotomy shortened the second stage of labor,¹³² but benefits to the infant from a shortened second stage have not been demonstrated.¹³³

Vaginal and Perineal Lacerations

Four retrospective studies have been published that fail to support the use of episiotomy. Reynolds and Yudkin^{134,135} analyzed 24,439 deliveries between 1980 and 1984, when there was a marked decline in the rate of episiotomy in a large British obstetrics unit. The percentage of women with an intact perineum after delivery increased from 7.4% to 13.7% for primiparas and from 26.1% to 33.8% for multiparas. The rate of third-degree tears remained constant throughout the period. Buckins et al¹³⁶ analyzed the relationship of episiotomy to third-degree perineal tears in 21,278 singleton deliveries. After stratification for birthweight and parity, no relationship between episiotomy and third-degree tear was found. Grass et al,¹³⁷ in a study of the frequency of vaginal outlet lacerations, found third- and fourth-degree tears only in women with episiotomies. The authors appropriately noted that the use of episiotomy was not random, and that these same women might have experienced the same morbidity in the absence of an episiotomy. Green and Soohoo¹³⁸ used multivariate analysis to examine factors associated with rectal injuries in 2076 spontaneous cephalic deliveries. After adjusting for parity, type of birth attendant (physician or midwife), location of delivery (delivery room or labor bed), birthweight, and ethnicity, women with a midline episiotomy were 8.9 times more likely to experience rectal injury than women with no episiotomy.

In a prospective, nonrandomized trial by Thorp et al,¹³⁹ the findings were similar. In this study, one operator performed episiotomy only for operative deliveries and those involving fetal distress, while other deliveries were performed with liberal use of episiotomy by operators with comparable degrees of experience. Only

women with an episiotomy had third- or fourth-degree lacerations; the overall rate of third- and fourth-degree lacerations in the selected use group was 1.8% and 14% in the unrestricted use group. The difference was most striking in births of infants weighing more than 3400 g.

Only two randomized clinical trials have been published, both performed in Great Britain, where the standard of care is a mediolateral episiotomy. In the West Berkshire Perineal Management Trial,¹⁴⁰ a restrictive and a liberal approach to episiotomy were compared, resulting in rates of 10% and 51%, respectively. Short-term morbidity measures were comparable in the two groups, and women in the restrictive group were more likely to have resumed sexual intercourse within a month after delivery. A randomized clinical trial of 181 primigravid women who gave birth in Dublin¹⁴¹ assessed the degree of pain, bruising, and swelling of the perineum and ingestion of analgesics in the first 4 days after delivery, and again at a checkup 6 weeks postpartum. Women with no lacerations or episiotomy fared the best, with no difference found between those undergoing episiotomy and those sustaining a second-degree tear.

Pelvic Relaxation

Few studies have addressed pelvic relaxation or other measures of long-term morbidity. VanGeelen et al¹⁴² examined the urethral pressure profile in pregnancy and after delivery of nulliparous women and found less loss of urethral length in patients with cesarean section than in those with vaginal deliveries. Of those with vaginal deliveries, no differences were observed between patients who did or did not have an episiotomy. Gordon and Logue,¹⁴³ using a perineometer to measure perineal muscle function 1 year after delivery, found a strong correlation between muscle function and regular exercise, with no relationship between the degree of perineal trauma and subsequent muscle function. The West Berkshire Perineal Management Trial¹⁴⁴ was able to obtain 3-year follow-up data for two thirds of the women randomized, with no differences found between the groups in dyspareunia or incontinence of urine.

Injury to the Newborn

Virtually no data have appeared on the role of episiotomy in preventing injury to the newborn since Thacker and Banta's review.¹³¹ Reynolds and Yudkin¹³⁵ found no change in neonatal outcome with the decline in episiotomy rate. The West Berkshire Perineal Management Trial¹⁴⁶ found no difference in neonatal outcome between the two groups studied.

Morbidity

Evidence to date is inconclusive about both short-term and long-term morbidity associated with the use or lack of use of episiotomy. Data are accumulating that suggest a greater amount of rectal sphincter injury with the use of midline episiotomy compared with no episiotomy. Since women with an intact perineum have the best short-term morbidity experiences, and comparable experiences are found in women with episiotomies and tears, it is reasonable to conclude that the short-term morbidity experience is better when routine episiotomy is not performed.

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