

Update on Nonpharmacologic Approaches to Relieve Labor Pain and Prevent Suffering

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Abstract and Introduction

Abstract

The control of labor pain and prevention of suffering are major concerns of clinicians and their clients. Nonpharmacologic approaches toward these goals are consistent with midwifery management and the choices of many women. We undertook a literature search of scientific articles cataloged in CINAHL, PUBMED, the Cochrane Library, and AMED databases relating to the effectiveness of 13 non-pharmacologic methods used to relieve pain and reduce suffering in labor. Suffering, which is different from pain, is not an outcome that is usually measured after childbirth. We assumed that suffering is unlikely if indicators of satisfaction were positive after childbirth. Adequate evidence of benefit in reducing pain exists for continuous labor support, baths, intradermal water blocks, and maternal movement and positioning. Acupuncture, massage, transcutaneous electrical nerve stimulation, and hypnosis are promising, but they require further study. The effectiveness of childbirth education, relaxation and breathing, heat and cold, acupressure, hypnosis, aromatherapy, music, and audioanalgesia are either inadequately studied or findings are too variable to draw conclusions on effectiveness. All the methods studied had evidence of widespread satisfaction among a majority of users.

Introduction

The management of labor pain is one of the main goals of maternity care. The two models of care, often referred to as the medical model and the midwifery model, use fundamentally different means to achieve that end. In the former, the emphasis is largely on the elimination of the physical sensation of labor pain, whereas in the latter, emphasis is largely on the prevention of suffering. Suffering includes any of the following psychological elements: a perceived threat to the body and/or psyche; helplessness and loss of control; distress; insufficient resources for coping with the distressing situation; even fear of death of the mother or baby.[1] This description of suffering resembles the American Psychiatric Association's diagnostic criteria for trauma.[2]

Although pain and suffering often occur together, one may suffer without pain or have pain without suffering. Furthermore, one can have pain coexisting with satisfaction, enjoyment, and empowerment. Loneliness, ignorance, unkind or insensitive treatment during labor, along with unresolved past psychological or physical distress, increase the chance that the woman will suffer. The physical sensation of pain is magnified and frequently becomes suffering when it coexists with these negative psychological influences.[3]

The goal of eliminating labor pain is based on the assumption that pain inevitably equals suffering. Such a goal requires not only pain medications, but also other medications, interventions, complex technology, and highly skilled personnel to control the accompanying undesirable side effects. Furthermore, the birthing environment must be designed for quick accessibility to these safety features. This model places the burden of pain control solely on medical professionals, and the woman's role is one of passive compliance. It requires that the care providers take the lead and dictate such basic human actions as eating, drinking, using the toilet, even rolling over in bed. As effective as the epidural is in reducing pain, it has psychological ramifications. Because the key to pain relief is held by others, the woman becomes more dependent and powerless, not only in managing her pain but in all other aspects of labor and birth. Self-confidence in the woman's own resources and capabilities and a willingness to be an active participant in her care are not assets in this model. Ironically, the intention to eliminate pain may increase the likelihood of some elements of suffering (i.e., helplessness, and insufficient resources for coping with distressing aspects of the birth).

The nonpharmacologic approach to pain includes a wide variety of techniques to address not only the physical sensations of pain but also to prevent suffering by enhancing the psychoemotional and spiritual components of care. Pain is perceived as a side effect of a normal process, not a sign of damage, injury, or abnormality. Rather than making the pain disappear, the midwife and other caregivers assist the woman to cope with it, build her self-confidence, and maintain a sense of mastery and well-being. In fact, the element that best predicts a woman's experience of labor pain is her level of confidence in her ability to cope with labor.[1] Reassurance, guidance, encouragement, and unconditional acceptance of her coping style are used. The woman and her partner or support persons are guided and supported in using self-comforting techniques and non-pharmacologic methods to relieve pain and enhance labor progress. With this kind of care, women perceive that they coped successfully with the pain and stress of labor and state that they were "able to transcend their pain and experience a sense of strength and profound psychologic and spiritual comfort during labor." [1]

The ideal environment for this approach fosters a sense of comfort and privacy and reflects the expectation that the woman will remain active and use a variety of techniques. It contains comfort aids and places to walk, bathe, and rest. Satisfaction, fulfillment, and a sense of accomplishment are often high, and suffering avoided, even when pain is great.[1] In fact, these positive reactions to childbirth are associated more with how a woman believes she was treated by her caregivers, her involvement in decision making, and whether her expectations were met, than with the amount of pain she feels.[4,5]

In this article, we review the effectiveness of the most widely used nonpharmacologic techniques, not only in relieving labor pain, but also in preventing suffering -- feeling overwhelmed, helpless, out of control, or in danger. Because there are few published articles that have examined degree of suffering as an outcome of childbirth, this article is based on the assumption that women who express satisfaction with a particular technique and/or with their childbirth experience overall are unlikely to have suffered.

Methods

We searched the literature for relevant systematic reviews, meta-analyses, and prospective controlled trials in the English language by using PUBMED, CINAHL, AMED, and the Cochrane Library. The following techniques, arranged roughly in order of findings of effectiveness, were reviewed: 1) continuous labor support; 2) hydrotherapy, 3) intradermal water blocks, 4) movement and positioning, 5) touch and massage, 6) acupuncture, 7) hypnosis, 8) transcutaneous electrical nerve stimulation (TENS), 9) aromatherapy, 10) heat and cold, 11) childbirth education, 12) self-help techniques such as patterned breathing and relaxation, and 13) music and audioanalgesia. Despite a large number of published articles, there are relatively few prospective trials of effectiveness of many of the techniques. We include them in our assessments of efficacy, when available. If no such trials exist, we refrain from assessing efficacy. We summarize relevant findings from published systematic reviews or meta-analyses and update these with summaries of more recently published studies. We recommend that the reader retrieve the original reviews for more complete presentations on each non-pharmacologic method.

Table 1 summarizes the psychophysiologic mechanisms through which each method is thought to effect pain reduction.

Continuous Labor Support

The term "continuous labor support" refers to non-medical care of the laboring woman throughout labor and birth by a trained person. The word "continuous," as it pertains to labor support, has been defined in various ways. In one study, in which staff nurses were the support providers, "continuous" was defined as "a minimum of 80% of the time from randomization to delivery." [6] In a meta-analysis of trials of labor support, "continuous" was defined as "without interruption, except for toileting, from shortly after admission to the hospital or entry into the study, and during the birth of the child." [7]

Labor support includes continuous presence, emotional support (reassurance, encouragement, and guidance); physical comforting (assistance in carrying out coping techniques, use of touch, massage, heat and cold, hydrotherapy, positioning, and movement); information and guidance for the woman and her partner; facilitation of communication (assisting the woman to express her needs and wishes); and nonmedical information and advice, anticipatory guidance, and explanations of procedures. Terms such as "doula," "labor assistant," "birth companion," "labor support specialist," "professional labor assistant," and "monitrice" refer to providers of this type of support. None of the included studies examined the effects of support by the woman's partner or husband, although untrained female family members or friends did fill that role in one published trial. [8]

Effectiveness of Continuous Labor Support in Reducing Pain and Suffering During Labor

Two recent systematic reviews of continuous labor support, a Cochrane Review[9] of all randomized controlled trials (RCTs), and a review of North American trials only,[10] reached similar conclusions.

The Cochrane Review examined 15 RCTs, including 12,791 women. Labor support was provided by a variety of people -- staff nurses (in 2 trials), staff midwives (4 trials), staff student midwives (2 trials), retired nurses and trained lay women (1 trial), trained lay women (doulas [3 trials], lay midwives [1 trial], childbirth educators [1 trial]), and untrained female relatives (1 trial).

Despite the variety of caregivers and settings in which the trials took place, the meta-analysis revealed that women who received continuous labor support were less likely to experience analgesia or anesthesia (including epidurals and opioids); instrumental delivery; cesarean birth; and were less likely to report dissatisfaction or a negative rating of their birth experience. Further analysis of the results indicated greater benefit if the labor support provider was not a member of the hospital staff with clinical care responsibilities, and whose only task was to provide continuous support to one laboring woman throughout her labor.[9] Women receiving support from non-hospital staff, compared to women who received no extra support, had 26% fewer cesarean births and 41% fewer instrumental deliveries. They were also 28% less likely to use any analgesia or anesthesia and 33% less likely to be dissatisfied or to rate their birth experience negatively.[11]

Continuous Labor Support in North American Hospital Settings

A systematic review of 9 trials was conducted to compare outcomes of continuous labor support versus "usual care" in North American settings, where baseline obstetric intervention rates are high and midwifery care is rare (as opposed to the study settings in Europe and Africa where intervention rates were low and midwifery care was standard).[10] The findings were similar to those reported in the Cochrane meta-analysis, although the benefits of continuous support were not as striking in the North American settings. In 7 of the 9 trials, comprising a total of 2259 women, the labor support was provided by trained lay women (doulas). In the other 2, plus a third trial[6] that was published after the systematic review, the support was provided by either retired nurses or staff nurses. These 3 trials, in which nurses provided continuous support, included 8052 women. They found no differences in pain medication use or other obstetric outcomes, compared with usual care. The 2 trials that reported on maternal satisfaction, however, found increased satisfaction in the continuous support groups.

[Table 2](#) and [Table 3](#) summarize the outcomes of the 10 trials of continuous labor support that have been conducted in North American hospitals to date.

In summary, in all the RCTs of continuous labor support published to date, both in North America and throughout the world, pain and pain relief were measured indirectly by using rates of pain medication as the indicator of effectiveness of pain relief. Pain was reduced by continuous labor support in most of the trials, particularly those in which laypersons trained as doulas provided the support. The trials in which nurses provided the support (either hospital employees or

independent nurses) showed the least benefit. Furthermore, support begun in early labor seems to have provided greater benefit than when begun in active labor. Maternal satisfaction, though not assessed in every trial, was higher in the supported groups. A common model of labor support in North America -- the private practice doula who is chosen by and becomes known to the woman or couple prior to labor -- has never been studied in RCTs.

Baths in Labor

Immersion in warm water deep enough to cover the woman's abdomen is used to enhance relaxation, reduce labor pain, and promote labor progress. Baths have become a popular option in many countries, including the United States. Women usually remain in the bath for a few minutes to a few hours during the first stage of labor. Birth in water is not the focus of this article. Showers during labor, though commonly used, have not been subjected to scientific study and are not discussed.

The first scientific publication on the use of water in labor was published in 1973.[21] It reported on the first 100 births in which water was used for labor in a hospital in France. Since then, bathing during labor has been widely studied for its benefits and risks.

Effectiveness of Bathing in Reducing Pain and Suffering in Labor

A recent systematic review analyzed findings of 2 prospective cohort studies and 7 RCTs of bathing published between 1987 and 2001.[10] A total of 3496 women participated in these trials. Sample sizes in the individual trials ranged from 18 to 1237. The trials varied widely in study designs and quality, timing of entry into the water, water temperature, and in baseline rates of epidural analgesia and other interventions, as reflected by the rates in the control ("usual care") groups. Of the 3 best designed RCTs, 2 found a reduction in pain indicators in the bath groups[22,23] 1 one did not.[24] Of the 2 that found decreases in pain in the bath group, 1[22] (N = 109) found an initial decrease in pain upon entering the water, followed by a slower rise in pain scores during the 1-hour study period than the control group, whose pain rose continually and more rapidly to higher levels. Maternal satisfaction was high in the bath group, with 89% stating they would like to use the bath in a future labor. In the other[23] (N = 785), the women randomized to the bath group required fewer epidurals (59.8% vs 66%, $P < .02$), even though almost half in the bath group opted for an epidural rather than the bath! If the data had been analyzed by using those who actually complied with their assigned protocol, the effects would probably have been more striking, but the requirements of the scientific method are that the analysis be done on the basis of group assignment ("intention to treat"), whether or not they actually received the treatment. The one trial that found no difference in epidural use[24] was a large, well-designed trial, but the baseline rate of epidural analgesia was 20%, which would be difficult to lower with the intervention of a 1-hour bath. Because epidural analgesia was used by only 20% of the laboring women in the participating hospitals, it was unfortunate that other pain indicators, such as maternal assessments of pain or satisfaction, were not assessed in this trial.

One RCT[25] of bathing in labor has been published since the above-mentioned systematic review.[10] Participants included 99 nulliparas with dystocia, who were randomly assigned to a control group to receive usual augmentation procedures (amniotomy and/or oxytocin) or to the experimental group for immersion in a birth pool for up to 4 hours, after which their progress was assessed and the standard dystocia protocol initiated, if necessary. Fewer women in the bath group received epidural analgesia than in the control group (47% vs 66%; RR 0.71, 95% CI 0.49-1.01 -- almost statistically significant). The number who received augmentation in the bath group was significantly lower than in the control group (71% vs 96%; RR 0.74, 95% CI 0.59-0.88). In postpartum interviews, the bath group reported less labor pain 30 minutes after the onset of the allocated management and less overall labor pain. There were no differences in the length of labor or in surgical delivery rates. Overall maternal satisfaction was the same in both groups.

Women's experiences of immersion in water during labor and birth have received little study. A qualitative survey of 189 women was published recently in England.[26] Eighty-one per cent stated they would have another water birth in the future. When asked to describe their feelings when they entered the pool, the most common words were "relaxation" (n = 99); "relief" or "pain relief" (n = 101); and "warmth" (n = 48). Thirty-nine said they felt more in control.

The use of water requires special equipment in the form of bathtubs. Furthermore, there are some practical or safety considerations: the temperature of the water should be at body temperature; the timing of entry and duration of the bath can influence labor progress. Labor progress can be slowed if the woman enters the bath before active labor or stays in for more than 1 or 2 hours.[10] Guidelines for midwives in the safe use of water during labor are available.[27,28]

The results of these studies indicate that, with appropriate attention to water temperature, duration of the bath, and safety considerations, baths in labor are effective in reducing pain and suffering during labor, and should be available as a pain relief option to all laboring women.

Intradermal Water Blocks

Intradermal water blocks, also called intracutaneous sterile water injections, decrease low back pain during labor.[10] Estimates of the incidence of low back pain in labor range between 15% and 74% of all labors.[29] Possible etiologies of low back pain in labor include a fetal occiput posterior position, persistent asynclitism, the woman's individual lumbopelvic characteristics, and referred pain from the uterus. Because the corpus uteri and cervix are supplied by afferent neurons ending in the dorsal horn of spinal segments T10-L1 and cutaneous afferents from the low back converge in the same segments, there is anatomical support that low back pain in labor is actually referred pain.[30]

Intradermal water blocks consist of 4 intradermal injections of 0.05- to 0.1-mL sterile water (using a 1-mL syringe with a 25-gauge needle) to form 4 small blebs, 1 over each posterior superior iliac spine and 2 others placed 3 cm below and 1 cm medial to each of the first sites. Exact locations of these do not appear to be

critical to its success[31] (Figure 1).

Figure 1. Placement for injections of intradermal water blocks.

The injections sting acutely for 20-30 seconds, but as the stinging fades, the back pain fades. Using saline injections instead of sterile water causes less initial intense stinging and is less effective in decreasing low back pain.[32,33] To offset the discomfort of administration, some providers give injections during a contraction and have 2 providers give 2 injections simultaneously to speed the process. The water blocks can be repeated as desired.[31]

Effectiveness of Intradermal Water Blocks in Decreasing Labor Pain and Suffering

All of the 4 published RCTs compared low back pain in an experimental group who received intradermal water blocks and a control group who received either a "placebo" blank (using saline)[30,32,33] or an alternative nonpharmacologic method (TENS, movement, massage, and baths).[29] The findings are summarized in Table 4. All 4 studies found that the intradermal water blocks were effective in decreasing severe low back pain in most laboring women within minutes. Pain relief lasted 45 to 120 minutes, and most women stated they would want to use intradermal water blocks again during a subsequent birth.[30,32,33] In the 3 studies that investigated requests for other pain medication,[29,32,33] there was no decrease in the requests in the group of women treated with intradermal water blocks, despite the pain relief provided by them. Possible explanations for this finding are that the block decreased only low back pain (not abdominal labor pain) and that pain relief only lasted up to 120 minutes, after which the water blocks were not repeated. One study[29] compared the efficacy of 3 different treatments to decrease low back pain: intradermal water blocks, TENS, and "usual care," including massage, ad lib baths, and movement. Even though the water blocks were effective in decreasing low back pain, more in the usual care group wanted to repeat the treatment they received and had the lowest requests for pain medication. The largest trial,[33] which was well designed and had low risk of bias, found that the number of cesarean deliveries was significantly lower in the group who received the intradermal water blocks.

In summary, 4 RCTs have found that intradermal water blocks reduce severe low back pain in most laboring women without any identified side effects on the fetus or mother, except for the transient, though extreme pain, with administration. It is a simple and inexpensive way to provide a medication-free option to women who want to either avoid or delay use of epidural analgesia or for those for whom epidurals are not available.[10] Further research is needed on the effects of intradermal water blocks on obstetric outcomes, the effects of repeated injections, ways to decrease the stinging of the injections without losing benefits, its mode of action, and the effects of varying dosages, locations, and number of sites injected.

Maternal Movement and Positioning

Historically and cross-culturally, laboring women have always walked, moved,

and changed positions spontaneously to make themselves more comfortable.[34,35] Observational studies indicate that this is still true in settings where the environment is conducive.[36,37] Besides self-initiated comfort-seeking movements, women's caregivers often suggest specific positions that are thought to accelerate labor progress, slow down expulsion, or correct a fetal or maternal problem (e.g., fetal heart rate decelerations, malposition, maternal back pain or other pain, blood pressure abnormalities, or inadequate contractions). In most birthing environments today, however, women are restricted from walking or moving freely, not because it is intrinsically dangerous, but because with conventional obstetric management, it is nearly impossible. In fact, "Listening to Mothers," a national survey of childbearing experiences in the United States between the years 2000 and 2002,[38] found that after admission to the hospital, most women (71%) did not walk around. The most common reason they gave was that they were "connected to things" (67%), followed by "unable to support self due to pain medication" (32%), and "told not to walk around" (28%). Sixty percent, however, did report changing positions (presumably while in bed) to relieve pain during labor.

Pelvic dimensions vary with differences in maternal positions, according to a study of 35 nonpregnant nulliparous and parous women using magnetic resonance imaging.[39] Both squatting and kneeling while leaning forward increased the anterior-posterior and transverse diameters in both the midpelvis and pelvic outlet, compared with the supine position (interspinous diameter increased 8 ± 7 mm in squatting and 6 ± 7 mm in kneeling, $P < .001$).[39] Squatting also increased the intertuberous diameter (3 ± 7 mm, $P = .01$) and decreased the obstetric conjugate diameter (2 ± 4 mm, $P = .01$). The findings noted in this study can be expected to be even more dramatic in pregnant women who have more joint mobility. Pelvic dimensions change with movement -- walking, swaying, lunging, or flexing and extending the legs. Such movements are thought to facilitate fetal rotation or descent, which could, in turn, mitigate the pain associated with abnormal positions or prolonged labor.[40]

Effectiveness of Maternal Position Changes in Reducing Pain and Suffering During Labor

First Stage of Labor. Most scientific trials of movement and positioning during labor have compared various upright positions with horizontal positions for their effects on pain and labor progress. Our search revealed 14 controlled trials of positioning during the first stage of labor in healthy women at term. Thirteen were included in a recent systematic review of selected nonpharmacologic methods of pain relief,[10] and one[41] was published after the review. Eight of these trials ($N = 311$) used each woman as her own control by having her take one specified position for 15 to 30 minutes and then alternate to another for the same length of time. In 7 of these, the women were asked to alternate positions several times or until complete dilation; in one,[41] they took each position only once. The positions included sitting, standing, or walking versus supine or sidelying; hands and knees versus supine or sidelying; and other combinations. The women's pain and progress were assessed in each position.

None of the women in these 8 trials found the supine position more comfortable

than other positions. Comparing 30-minute periods of standing with supine or with sitting, the women reported less pain while standing. Comparing sitting with supine, the women reported less pain while sitting. Comparing sitting with sidelying, the women reported less pain with sitting until 6 cm and then less pain with sidelying from 7 to 10 cm. Other comparisons revealed few differences in pain indicators. Vertical and sidelying positions were accompanied by more progress than sitting or supine.

Six other trials evaluated in the systematic review[10] (N = 2629) compared 2 groups -- an experimental group who were encouraged to remain upright (sit up, stand, or walk) during the first stage, and a control group, who remained sidelying or supine. Except for one trial, the upright women were allowed to lie down if they wished. Of these 6 trials, 3 found decreased pain in upright positions, 2 found no difference, and 1 (in which women were forced to remain upright throughout the first stage) found increased pain. Three trials found decreases, and 3 found no differences in duration of labor. No trial found longer labors in the women who assumed upright positions. One trial assessed satisfaction with the option of walking, which was very high in the upright group. No trial found that upright positions caused any harm to healthy women.

Second Stage of Labor. A recent Cochrane Review of 19 randomized controlled trials[42] (N = 5764) compared supine positions with upright positions during the second stage of labor. Most investigated such outcomes as duration of second stage, maternal perineal condition, postpartum bleeding, newborn outcomes, and others. Only one of the trials asked women to rate their pain.[43] In this study, fewer women in the group assigned to a squatting position reported severe pain than those in the group assigned to a supine position. The authors of this Cochrane Review concluded that there is no indication of harm from upright positions during second stage and that "... women should be allowed to make informed choices about the birth positions ... they might wish to assume for delivery of their babies." [42]

In summary, these trials in both the first and second stages of labor suggest that the use of upright positions, interspersed with other positions, decreases pain and may shorten labor. No trials of positions have compared a policy of restriction of movement with a policy of freedom of movement. However, several descriptive studies report findings consistent with pain reduction and enhanced satisfaction from freedom of movement; for example, women voluntarily change position during labor and birth when unrestricted,[36,37] they express satisfaction if encouraged to move freely,[10] but they are frequently kept from moving freely in the hospital environment.[38] Furthermore, the fact that there were high rates of attrition in the trials in which women were assigned to prolonged periods of upright positions also indicates that women prefer to change positions freely. Until appropriate studies produce new information, women with no risk factors should be educated about potential advantages for comfort and labor progress and encouraged to move freely in labor and birth.

Touch and Massage

Touching another human being can communicate positive messages such as caring, concern, reassurance, or love. Massage, "the intentional and systematic manipulation of the soft tissues of the body to enhance health and healing,"[44] is used during labor to enhance relaxation and reduce pain and suffering. A systematic review[10] identified 2 RCTs: one on touch and one on massage. A third trial was published since the review.[45]

Effectiveness of Touch and Massage in Reducing Pain and Suffering During Labor

One of the trials[46] included in the systematic review studied 90 women. The "touch" group received 5 to 10 seconds of reassuring touch each time the woman expressed anxiety during a 30-minute period between 8- and 10-cm dilation. The controls received usual care. The women's blood pressure and the number of expressions of anxiety significantly decreased in the "touch" group. The postpartum assessments of anxiety during the study period were lower in the "touch" group.

The second trial of massage[47] described in the systematic review (N = 28) randomized women to receive either usual care (control group) or massage of head, back, hands, and feet by their partners for 20 minutes per hour for 5 hours during labor. The frequent massage reduced the women's pain and anxiety and improved their mood.

A more recent RCT conducted in Taiwan[45] included 60 women, 30 of whom received massage and 30 women in a control group who received usual care. The primary researcher gave massage 3 times, once during each phase of labor (latent, active, and transition), and taught the woman's partner how to do it. Massages lasted for 30 minutes in each phase, and were then repeated by the partner. Pain intensity was rated by a nurse observing each woman's manifestations of pain using a present behavioral intensity scale. Anxiety was measured by using a visual analog scale for anxiety. Although pain intensity increased steadily through progressing phases of labor, the massage group had statistically significant lower pain intensity scores at each phase of labor (0.73 vs 1.30 in latent; 1.73 vs 2.17 in active; and 2.17 vs 2.87 in transition phases). Anxiety levels were significantly lower in the massage group during the latent phase (37.2 vs 53.5 on a 100-point scale); 87% of the women in the massage group reported that the massage was helpful in providing pain relief and psychological support.

There are few drawbacks to the use of touch or massage. The partners have to be taught appropriate massage techniques before labor (i.e., in childbirth classes) or during labor (i.e., by a skilled doula, nurse, midwife, or massage therapist). These few small studies indicate that women appreciate being touched and massaged during labor, and these simple interventions may reduce pain and enhance feelings of well-being.

Acupuncture and Acupressure (Shiatsu)

Acupuncture, an important and ancient component of traditional Chinese

medicine, is gradually being integrated with conventional medicine in the West. Acupuncture is believed to initiate, control, or accelerate physiologic functions, and thus, correct organ malfunctions, heal illnesses, or relieve discomforting symptoms through insertion of fine needles into the skin at a combination of specific points along meridians (channels of energy, called "Qi," pronounced "chee") in the body, followed by rotation, heating, or electrical stimulation (electro-acupuncture) of the needles.[48] There are 12 meridians and 365 acupuncture points along those meridians. The decision on where and how deep to place the needles is based on numerous general factors, including the nature of the ailment, the person's lifestyle, diet, work, emotional state, pulse, and the appearance of the person's tongue. For labor pain, placement of needles depends on degree and location of pain, stage of labor, level of maternal fatigue, tension, or anxiety, and a variety of other factors.[49]

Midwives in the United Kingdom and Scandinavia may obtain additional training in the use of acupuncture during childbearing, and many now offer it to their clients. In North America, acupuncture is rarely used during childbirth, but when it is, trained acupuncturists do it at the request of the laboring woman or the midwife, and it is used almost exclusively in out-of-hospital birth settings.

Acupressure, or Shiatsu, a simple alternative to acupuncture, is pressure with fingers or small beads on acupuncture points. It is used for numerous ailments and discomforts in pregnancy, as well as for labor pain. Because acupressure can be done with minimal instruction by the woman's partner, it may be desired by some laboring women. There are no published trials of its efficacy in relieving labor pain.

Effectiveness of Acupuncture in Reducing Pain and Suffering During Labor

Although numerous positive descriptive and retrospective reports on acupuncture had been published over the previous decades,[50,51] it was not until 2002[52,53] and 2003[49] that the first 3 RCTs of acupuncture for pain relief in labor were published. These included a total of 598 women. All compared pain assessments by either a visual analog scale during or after labor or by comparing the use of epidural analgesia or intravenous narcotics between those women randomly allocated to acupuncture and a control group (receiving either no acupuncture or "false acupuncture"). They also evaluated patient satisfaction with acupuncture. Women's reports of pain were significantly lower in the acupuncture groups in all 3 trials. Maternal satisfaction was high among all the women in both the acupuncture and control groups.

Skilnand et al. compared a "real" acupuncture group (n = 106) with a "false" or "minimal" acupuncture group (i.e., needles were inserted shallowly in non-acupuncture points) (n = 102).[52] Pain assessments on an 11-point visual analog scale before the acupuncture was started were the same in the 2 groups but significantly lower in the real acupuncture group 30, 60, and 120 minutes after acupuncture was given. Assessments at 2 hours postpartum of their total pain during labor were also lower in the real acupuncture group. Furthermore, in the real acupuncture group, there was significantly less need for epidural analgesia (10% vs 25.5%, $P = .01$) or Pethidine (Demerol) (14% vs 35%, $P < .001$).

Ramnero et al. studied pain and relaxation with and without acupuncture in 100 women (n = 46 in the acupuncture group and n = 44 in the no acupuncture group).[53] Although there was no difference in pain assessments between the groups on an 11-point rating scale, there was significant improvement in relaxation in the acupuncture group: mean score on a visual analog scale measuring tension of 4.2 in the study group and 5.1 in the control group (mean difference, -0.93 , 95% CI -1.66 to -0.20). The acupuncture group also used less epidural analgesia (12% vs 22%; RR 0.52, 95% CI 0.30-0.92). Maternal satisfaction was high in both groups.

A third RCT by Nesheim et al. compared the use of meperidine (Demerol) in 3 groups: acupuncture (n = 106), a "no acupuncture" control group (n = 92), and a second control group (n = 92).[49] The first 2 groups were cared for by the same midwives, who were trained and experienced in the use of acupuncture. To control for bias that might result from unblinded caregivers for the 2 groups, another control group was added, consisting of women who had not been invited to take part in the trial. These women were matched with women in the no acupuncture group but were cared for by midwives other than those in the trial. Meperidine was used by 11% in the acupuncture group and 37% in the no acupuncture group ($P < .0001$) and 29% in the control group ($P = .01$ compared with the acupuncture group).

There are no known risks to women who use acupuncture, when practiced by trained practitioners using disposable needles. It requires extra training for midwives or doctors, or an acupuncturist must be a member of the maternity care team.

In conclusion, three RCTs of acupuncture found that it provides an effective alternative to pharmacologic pain relief. It may be useful for those women who want to avoid or delay pain medications or in settings where pain medications are not available. Satisfaction was high with acupuncture, but this was also true in the control groups. Because extra surveillance of the fetus and assistance from anesthesiologists are not needed, care of the laboring woman is simpler and less expensive with acupuncture than with an epidural. More large studies are warranted to establish cost-effectiveness, implementation in maternity care settings, and acceptance by childbearing women.

Hypnosis

Hypnosis has been used to reduce childbirth pain since the early 19th century. Judging from the number of published articles on the subject, hypnosis seems to have been most widely accepted by maternity care providers during the 1950s and 1960s. With the improvement in obstetric analgesia in the 1960s and later, the popularity of hypnosis declined. Today, the interest in hypnosis training to shorten labor and decrease childbirth pain is increasing among holistic practitioners and expectant parents.

Hypnosis is "a state of deep physical relaxation with an alert mind producing alpha

waves, and it is in this state that critical faculties are suspended and the subconscious mind can be more readily accessed." [54] In this state, the individual has increased suggestibility. Hypnosis for childbirth is almost always self-hypnosis; in other words, the hypnotherapist teaches the woman to induce the hypnotic state in herself during labor. Sometimes her partner is taught to signal her into the hypnotic state. Common hypnotic pain relief techniques are "glove anesthesia," in which the woman imagines that her hand is numb and that it can spread numbness to other areas by placing her hand on painful areas; "time distortion," which enables the woman to perceive the time between painful contractions as longer and the painful period as shorter than it really is; and "imaginative transformation," in which the pain is interpreted as benign and acceptable, and contractions are seen as surges of energy that cause only a light pressure sensation. [55]

Effectiveness of Hypnosis in Reducing Labor Pain and Preventing Suffering

The Cochrane Review [56] included 3 RCTs on hypnosis for childbirth that met the criteria for inclusion in the meta-analysis. [57-59] A total of 172 women participated in the 3 trials. All trials reported on the use of pharmacologic pain relief. One [57] found no difference between hypnosis and control groups (6 of 29 in the hypnosis group vs 7 of 36 controls; RR 1.06, 95% CI 0.40-2.82). One trial found a decrease in use of anesthesia (RR 0.65, 95% CI 0.38-1.11). [58] Another found a decrease in use of narcotics (RR 0.21, 95% CI 0.08-0.55). [59] "Current evidence suggests hypnosis may be effective in reducing pain in labor. When adjusting for heterogeneity between trials there was insufficient evidence of reduced use of pain relief medication among women receiving hypnosis." [56] One trial evaluated maternal satisfaction with childbirth and reported increased satisfaction in the hypnosis group (RR 2.33, 95% CI 1.15-4.71). [57] There were no differences in adverse obstetric or neonatal outcomes between hypnosis and control groups.

Hypnosis is contraindicated in persons with any history of psychosis. [54] Any phobias or distressing situations need to be ascertained and avoided when suggesting a visualization intended to be relaxing. [54] Because hypnotized people are vulnerable to suggestion, the midwife and others involved in the care of this laboring woman should be aware that she is using hypnosis and should focus on "the positive" wherever possible. There are no apparent drawbacks or risks to the use of hypnosis for childbirth, except for the financial costs required for prenatal training of the woman or couple by a trained hypnotherapist.

Hypnosis is a promising technique for labor pain reduction and enhancement of maternal satisfaction with labor. More large trials are necessary to establish its true value. Because it appears to be harmless and participation is voluntary, its use should not be discouraged by caregivers.

Transcutaneous Electrical Nerve Stimulation

Transcutaneous electrical nerve stimulation (TENS) is the transmission of low-voltage electrical impulses from a handheld battery-powered generator to the skin via surface electrodes. Long used in much of the world for control of chronic or

postsurgical pain as an adjunct to or replacement for pain medication, TENS was introduced into maternity care in Scandinavia in the 1970s. Today it is widely used and rated highly by users in the United Kingdom, Scandinavia, parts of Canada, and in other countries. In fact, TENS units, designed for convenient use by the woman in labor, are available for rent without a doctor's or midwife's order in drugstores and medical equipment companies in those countries. TENS is not widely used for labor pain in the United States, although physical therapists can provide TENS units and teach expectant parents how to use them.

To relieve labor pain, one pair of electrodes is placed paravertebrally at the level of T10-L1 and another at the level of S2 to S4 (Figure 2). The woman controls the intensity of the current by turning a dial and varies the stimulation pattern with a thumb switch or by adjusting dials on her TENS unit. TENS causes a buzzing or prickling sensation that may reduce her awareness of contraction pain.

Effectiveness of TENS in Reducing Pain and Suffering During Labor

A 1997 systematic review of 8 trials of TENS for labor,[60] including a total of 812 women, found that women's ratings on a visual analog scale during labor or postpartum assessments by the women indicated no less pain with TENS than usual care. However, analgesics were used less by TENS users (OR 0.57, 95% CI 0.34-0.96), and 54% of TENS users stated they would use it in a future labor (compared with 32% who had "sham" TENS).

One more recent trial of TENS,[61] including 104 women, found shorter duration of first-stage labor among nulliparas (12 ± 4 hours vs 14 ± 4 hours, $P < .001$) and multiparas (9 ± 3 vs 10 ± 3 , $P < .005$), and later introduction of pain medication (5.2-cm dilation vs 2.5 cm among nulliparas, $P < .0001$; 7.1 cm vs 4 among multiparas, $P < .0001$) in the TENS users than the control groups. The majority of all TENS users considered TENS effective for pain relief and would use it again in future labors.

Experienced practitioners state that TENS may be more effective if initiated in early labor, presumably to allow for a build-up in endorphin production before the pain becomes severe. Furthermore, TENS may be more effective for relief of back pain than labor pain in general, but only 2 older studies have investigated this possibility.[62,63]

The satisfaction expressed by women with TENS may relate to other factors beside pain relief. TENS allows the woman to be in control of its use, allows ambulation, has no effects on her mental state, and gives an option to those who wish to avoid or delay medications.

There are few potential side effects from TENS when used by healthy individuals. Although rare if used with electronic fetal-monitoring equipment, TENS may interfere with the output from the monitor, in which case, either the TENS or the monitor should be discontinued or used intermittently. There is expense involved in renting or purchasing the units, and presently, it is difficult for Americans to obtain the units that are designed for use during labor. At present, suppliers of obstetrical TENS units can be found on the Internet.

TENS provides modest pain relief benefits and is a satisfying option for most women who use it. Its efficacy in relieving back pain deserves further study.

Aromatherapy

Aromatherapy is "the science of using highly concentrated essential oils or essences distilled from plants in order to utilize their therapeutic properties."^[64] For the purposes of this article, we focus on the use of essential oils to reduce anxiety and pain in labor. Aromatherapy for these purposes has not been studied with properly controlled trials. This modality is included here because its use in maternity care is increasing, and experts state that "Essential oils are as potent as pharmacological drugs and are equally open to misuse or abuse, whether intentional or not," and, "... until more clinical research trials have been undertaken it would be prudent for midwives to work cautiously with essential oils, using the lowest possible dose and on the least number of occasions."^[64]

Effectiveness of Aromatherapy in Reducing Pain and Suffering During Labor

One large, uncontrolled prospective study^[65] reported on the use and effectiveness of aromatherapy in a large referral maternity unit in the United Kingdom over an 8-year period between 1990 and 1998. During this time, 8058 women received aromatherapy during labor under the supervision of midwives trained in aromatherapy. It was used for a variety of purposes: to reduce fear, anxiety, and pain; to reduce nausea or vomiting; to enhance women's sense of well-being; and to improve contractions.

Meticulous records were kept regarding the oils used, the mode and timing of administration, and reasons for use. Mothers and midwives reported on the effectiveness of the oils in accomplishing the purpose for which it was given.

Sixty-one percent of the women received aromatherapy (lavender, rose, or frankincense) to relieve anxiety and fear. Fifty percent of both mothers and midwives found it helpful, and 13% found it unhelpful. Rose oil was rated helpful by most (71%), followed by lavender (50%). Lavender and frankincense were used for pain by 537 women, of whom 54% found lavender helpful and 64% found frankincense helpful.

Essential oils have a range of possible adverse effects on the woman, as well as on others in the room, because they are volatile and produce vapors that are inhaled by everyone in the vicinity. One percent (n = 100) of women in the study^[65] reported undesired effects associated with the use of aromatherapy; all were minor (nausea, rash, headache, or rapid labor). It is not clear whether they were caused by essential oils, other factors, or by labor itself.

In conclusion, aromatherapy is inexpensive and popular with laboring women and midwives. One large uncontrolled study reported that the majority of users found it helpful in reducing pain and anxiety. On the basis of these findings, and its

increasing popularity, this modality merits further scientific study to establish its rightful place in maternity care.

Application of Heat and Cold

Superficial applications of heat and/or cold, in various forms, are popular with laboring women. They are easy to use, inexpensive, require no prior practice, and have minimal negative side effects when used properly. Although there are no RCTs on the use of heat or cold during labor, these modalities have been studied for their effects on pain induced under experimental conditions.[66]

Heat is typically applied to the woman's back, lower abdomen, groin and/or perineum. Heat sources include a hot water bottle, heated rice-filled sock, warm compress (wash clothes soaked in warm water and wrung out), electric heating pad, warm blanket, and warm bath or shower. In addition to being used for pain relief, heat is used to relieve chills or trembling, decrease joint stiffness, reduce muscle spasm, and increase connective tissue extensibility.

There are no researched temperature guidelines, so using common sense is of key importance. The use of heat is contraindicated if the woman has a fever or is prone to hemorrhage, and it should not be used in regions of impaired sensation (as with analgesia or anesthesia). Because trials have correlated an increase in maternal temperature with the duration of the epidural,[67] it seems advisable to refrain from covering women who have epidural analgesia with warm blankets and to keep the ambient room temperature cool.[68]

Cold or cryotherapy is usually applied on the woman's back, chest, and/or face during labor. Forms of cold include a bag or surgical glove filled with ice, frozen gel pack, camper's "ice," a hollow, plastic rolling pin or bottle filled with ice, a washcloth dipped in cold water, soda cans chilled in ice, and even a frozen bag of vegetables. "Instant" cold packs, often available in hospitals, usually are not cold enough to effectively relieve labor pain. Women who already feel cold usually need to feel warm before they can comfortably tolerate using a cold pack. Chilled soda cans and rolling pins filled with ice give the added benefit of mechanical pressure when rolled on the low back. Cold has the additional effects of relieving muscle spasm and reducing inflammation and edema.[66]

A recent controlled study using a before and after study design evaluated the pain relief experienced by 49 women after applying ice massage to an acupuncture point on the hands.[69] The Hoku point, also called Large Intestine 4 (LI4), is located in the web space between the index finger and thumb on the hand. A washcloth filled with ice was rubbed over the Hoku point on the palmar surface of the hand during contractions and discontinued between contractions. The ice massage was carried out on one hand for 20 minutes and then was repeated on the other hand. The results revealed a significant reduction in pain when measured on a visual analog scale after the ice massage was applied.

Precautions and contraindications for cold application include cryoglobulinemia (gelling of blood), cold urticaria/hypersensitivity (cold-induced blisters, hives,

prolonged "goose bumps," itching), hypertension (because of vasoconstriction), Raynaud's phenomenon (blanching and paresthesias of the digits), or sickle cell anemia. Furthermore, cultural proscriptions and women's personal choice are factors to consider with the use of cold.

With both heat and cold, placing one or two layers of cloth between the woman's skin and the hot or cold pack is required to protect from the possibility of skin damage. In addition, it is imperative that the woman has intact sensation if heat or cold is to be applied. If a woman has an epidural/regional block, applying heat or cold to the anesthetized region is absolutely contraindicated because it could damage her skin. Because a woman may tolerate more extreme temperatures during labor than usual, partners or caregivers should test the temperature of the hot or cold pack first on themselves. If they can comfortably tolerate the hot or cold pack pressing on their forearm for several seconds, then it is safe to apply it to the mother with intact sensation.

In conclusion, except for one trial of ice massage, heat and cold have not been studied for their effectiveness in relieving labor pain. Efficacy has been established in reducing pain under other conditions, however, as well as reducing inflammation, edema, and muscle spasm. With appropriate safety precautions, heat and cold offer comfort and relief, and their use should be dictated by the desires and responses of the laboring woman.

Childbirth Education

Childbirth education (prenatal or antenatal education) consists of individual or group classes designed to inform pregnant women and their partners about labor and birth, early parenthood, and infant feeding. Prenatal classes come in various formats and cannot be considered a single entity.[70] Classes vary in theoretical perspectives, purposes, and goals of preparation, qualifications of instructors, number and length of classes, and population served.[71] Most prenatal classes are sponsored by hospitals or provider groups who employ the teachers. These classes are often based on the assumption that parents will receive epidural analgesia and other pharmacologic and medical intervention. They may not cover nonpharmacologic pain measures or self-help measures. Other community-based childbirth education organizations, such as Lamaze International, the International Childbirth Education Association, the American Academy of Husband-Coached Childbirth, Birthing from Within, and Birthworks, teach nonpharmacologic pain management, including relaxation, breathing techniques, attention focusing, movement/positioning, and other self-help comfort techniques that the woman and her support team can call upon in labor and birth.

Effectiveness of Childbirth Education in Reducing Pain and Suffering During Labor

Our literature search identified no recent trials of the effects of childbirth education on pain or prevention of suffering. The most recent meta-analysis concluded that there is insufficient evidence to determine the effects of person-to-person antenatal education for childbirth.[71] Although it is impossible to draw

evidence-based conclusions on the pain-relieving effects of childbirth education, its popularity testifies to a desire for parents to learn about this major life transition. Approximately 70% of first-time mothers and 19% of mothers who have experienced one or more births took childbirth classes between 2000 and 2002, according to the "Listening to Mothers" survey.[38]

There are few drawbacks to taking childbirth classes. There usually is cost and time involved, but the classes are completely voluntary and there often are several to choose from. The quality of information and length of the classes vary with each program, and the organization's goals and objectives may differ from the recipient's, so she should become informed about the classes and then choose the one that will best meet her needs.

Despite insufficient evidence on its influence on pain and suffering, childbirth education appears to be valued by expectant parents. As mentioned in the introduction, the best predictor of how a woman is going to experience labor pain is her self-confidence in her ability to cope with labor.[1] Although natural childbirth and active participation by parents (along with discussion of situations in which medications and interventions may be indicated) remain a focus of some classes, most focus more on preparation for conventional medicalized birth and a passive role for parents. If learning nonpharmacologic methods of managing labor pain is a goal, seeking out programs that teach these skills and boost the woman's self-confidence is essential.

Relaxation and Breathing

Most childbirth education classes and most books on childbirth present relaxation techniques, along with a variety of rhythmic breathing patterns intended to complement and promote relaxation or to provide distraction from labor pain. They are also used to enhance a woman's sense of control.[72,73] As stated above, the thoroughness of the teaching along with the amount of time devoted to rehearsing these techniques vary widely, from a quick mention or demonstration to repeated practice and adaptation to the individuals' preferences, with goals of mastery and confidence.

Effectiveness of Relaxation in Reducing Pain and Suffering During Labor

A recent survey of American women who gave birth between 2000 and 2002[38] found that 61% of the respondents used breathing techniques, and of those, 69% rated them as "very" or "somewhat" helpful, while 30% rated them as "not very helpful" or "not helpful at all." This finding may be a reflection of the quality of the teaching received by the women, or the fact that breathing techniques are not helpful for everyone. An older survey of British women found that 88% of women who reported using relaxation found it to be "good" or "very good." [74] Relaxation and breathing techniques have not been studied as independent variables in RCTs. It is not surprising that a recent report on women's use of these techniques found that women begin to use them more during early labor, but discontinue if or when they receive pain medications.[75]

There are no known drawbacks to the use of relaxation and breathing techniques, except that women sometimes expect more pain relief than they actually get from them during labor, and they express disappointment.

Relaxation and breathing may contribute more to a woman's ability to cope with labor pain than to actually reduce that pain. The high satisfaction expressed by large majorities of surveyed women justifies their continued inclusion in childbirth classes and encouragement of their use by maternity staff.

Music and Audioanalgesia

Audioanalgesia is the use of auditory stimulation, such as music, white noise, or environmental sounds to decrease pain perception. Its use is popular for the relief of pain during dental work, after surgery, and for other painful situations. It is also used during labor; in fact, many hospital maternity departments and birth centers provide CD/DVD tape players. Some women prefer to use headphones with a portable player, because the music provides more compelling distraction, and the woman is in constant control of the volume. Before labor, the woman selects her own music (sometimes with the help of a music therapist) or environmental sounds, based on her reactions to them. She may use these to rehearse relaxation or self-hypnosis, which then makes it easier for her to get into a relaxed or hypnotic state in labor. Choosing music that helps her relax, lift her spirits, or greet her baby personalizes the birth event and may give her a greater sense of control.[76]

Effectiveness of Music and Audioanalgesia in Reducing Pain and Suffering During Labor

Most studies of audioanalgesia during labor have reported that it can increase pain tolerance, reinforce or elevate moods, or cue the woman to move or breathe rhythmically, especially if she has conditioned herself to do so before the onset of labor. All the studies, however, have suffered from small sample sizes, inadequate controls, or lack of true differences between control and experimental groups.[77,78] It has not been clearly demonstrated that audioanalgesia has any of the benefits claimed for it.

There are no known drawbacks to using music or sound during labor.

Audioanalgesia is worthy of evaluation with properly controlled trials of adequate size to establish its true benefit or lack thereof. In the meantime, because there are no known adverse effects of audioanalgesia, and it appears to be a popular option for laboring women, its use should be encouraged.

General Conclusions on the Use of Nonpharmacologic Methods to Relieve Pain and Suffering in Labor

The techniques discussed in this article share several common properties:

1. Many are comparable or superior to parenteral opioids in their capacity to reduce pain sensations, but none are as effective as epidural analgesia.
2. Unlike parenteral opioids and epidural analgesia, they have few, if any, serious side effects and require few safety precautions or extra safety equipment.
3. They can be combined safely or used sequentially to increase their total effect.
4. They may be used instead of or as an adjunct to pain relief medications.
5. They are inexpensive and most are relatively easy to use.
6. The burden of pain control is not borne solely by the caregiver, but jointly by the woman, her labor support, and her caregivers. The woman is less dependent, and, in turn, the caregivers are able to assume more of a supportive and assistive role and less of a directive role during her labor.
7. They encourage active participation by the woman. She chooses the self-comfort measures and uses her own capabilities and support team to follow through.
8. They maintain or restore a sense of control to the woman. When given encouragement, support, and unconditional acceptance of her coping style, her self-confidence grows. A woman who is confident in using her own resources can cope with labor better, which leads to a sense of well-being and mastery and less likelihood of suffering.
9. They tend to be rated highly in terms of satisfaction and a desire to repeat them in a future labor. Even though their pain-relieving capability is modest or short-lived, they contribute positively to the psychoemotional, spiritual, social, and cultural aspects of her birth experience. When all aspects of the labor and birth are considered and respected, the likelihood of the woman suffering may significantly decrease.

Many of the techniques have been inadequately studied, and there appears to be little interest from funders to finance research on these seemingly simple, safe, and innocuous measures. We urge more research attention to these promising techniques. However, in the absence of clear scientific confirmation of their effectiveness, acceptability must be based on other criteria: absence of harm and preferences of each individual woman. Hospital birth environments, staff training, policies, and customs should be modified to accommodate the use of effective nonpharmacologic comfort measures, with the goal of reducing suffering in labor. This can be facilitated with comfort measures that provide sufficient pain relief and enhance the woman's sense of control and her satisfaction with her birth experience.

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