

Original Article

The effects of ice pack application on pain intensity in the active phase of labor and on birth satisfaction among primiparous women

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ABSTRACT

Background & Aim: Labor pain is an unpleasant experience for most women and can affect their birth satisfaction. This study investigated the effects of ice pack application on pain intensity in the active phase of labor and on birth satisfaction among primiparous women.

Methods & Materials: This randomized controlled trial was conducted on ninety primiparous women. Participants were randomly allocated to either an intervention or a control group. In the intervention group, an ice pack was placed on the sacral area of each participant in the active phase of labor for ten minutes. This intervention was repeated every thirty minutes up to the beginning of the second stage of labor. In both groups, labor pain intensity was assessed before and every one hour after intervention onset and birth satisfaction was assessed 24 hours after delivery. Data were analyzed through the SPSS software (v. 22.0).

Results: Groups did not significantly differ from each other respecting participants' demographic and clinical characteristics. Throughout the study intervention, labor pain intensity increased in both groups; however, the increase in the control group was significantly greater than the intervention group ($P < 0.001$). Moreover, the mean score of birth satisfaction in the intervention group was slightly greater than the control group, though this difference was not statistically significant ($P = 0.24$).

Conclusion: Without any significant side effects, ice pack application can significantly reduce pain intensity during the active phase of labor. Thus, this intervention is recommended for labor pain alleviation.

Introduction

Labor is a physiologic phenomenon. Yet, pain is an inevitable part of labor and an unpleasant experience for most women (1). Labor pain perception is affected by a wide range of factors such as age, number of deliveries, fear, anxiety, self-confidence, fatigue, physical strength, educational level, previous experience of labor pain, perceived emotional support, preparation and expectation from labor, and physical, sociocultural, and environmental conditions (2, 3). Pain threshold

and perception vary among women; therefore, they differ from each other respecting their responses to labor pain (4).

Labor pain can stimulate the sympathetic nervous system and increase plasma levels of catechol amines, which in turn increase vascular resistance, cardiac output, blood pressure, heart rate, and respiratory rate. Uncontrolled labor pain can also decrease uterine contractions, impair placental perfusion, prolong labor, alter fetal heart rhythm, and reduce Apgar score (1). Besides, it can cause women high levels of anxiety and can negatively affect women, fetus/neonate, and family relationships (5). Labor pain has also negative effects on women's birth satisfaction (3, 4).

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Birth satisfaction is defined as a woman's satisfaction with her experience during labor, delivery, and postpartum period (6). After maternal and neonatal health, birth satisfaction is the second most important issue in midwifery care (7). Birth satisfaction is multifactorial and determined by different factors such as labor pain intensity, labor duration, interventions during labor and delivery, prenatal education (8), pain management, emotional support, midwifery care, women's participation in perinatal clinical decision making (7), personal control, expectations and predictions, preparation for labor (9), care continuity, effective communication with healthcare providers, and trust in healthcare providers' practice (10). Currently, healthcare providers, managers, and policymakers consider birth satisfaction as a basic criterion for care quality assessment, healthcare-related decision making, and malpractice-related prosecution minimization (9, 11).

Birth satisfaction is greatly affected by labor pain, so that women with lower labor pain feel higher birth satisfaction and vice versa (3). Accordingly, effective management of labor pain is considered as the most significant predictor of birth satisfaction (4) and hence, labor pain management is among the most important goals of midwifery care.

There are both pharmacological and non-pharmacological therapies for labor pain management (17). However, in line with their therapeutic effects, pharmacological therapies are usually associated with numerous side effects for both pregnant women and their fetuses (18). On the other hand, non-pharmacological therapies for pain management not only may alleviate pain, but also can prevent psycho-emotional consequences of care (14). Cryotherapy (also known as cold therapy) is one of the non-pharmacological therapies for improving patient outcomes. It includes the application of any low-temperature substance to the body in

order to reduce tissue temperature (15). Cryotherapy alleviates pain through closing the gates to painful inputs, reducing the local release of pain mediators, blocking sensory nerves, and stimulating the release of endorphins (18). Moreover, it raises pain threshold by reducing the speed of pain signal transmission to the brain and relieving muscular spasm (19). Cryotherapy can be applied to the face, chest, back and other parts of the body using ice-filled surgical gloves, ice gel, and ice pack (16). Of course, ice pack is more effective than other cryotherapy types in reducing the speed and the extent of pain signal transmission to the brain (17).

Previous studies indicated the effectiveness of cryotherapy in alleviating labor pain. For instance, a study in 210 maternity units revealed that 44 of the units (21%) had used ice pack for labor pain management (20). A study on 46 pregnant women in the United States also showed that although 41 (91.1%) of the women had received educations in childbirth classes about cryotherapy use, only thirteen (28%) of them used it and reported its effectiveness (21). Another study found that twenty-minute ice pack application to the perineum significantly alleviated pain intensity after birth (22). Moreover, a study indicated that fifteen-minute heat therapy on the lower abdomen and low back followed by five-minute cryotherapy on the Hugo (L14) acupoint significantly reduced labor pain intensity and enhanced birth satisfaction, but had no significant effects on the duration of labor (23).

Despite the abundance of studies into the effects of cryotherapy on decrease postnatal perineal pain and ice massage on the Hugo, we could not find any study into the effects of cryotherapy application to the sacral area on labor pain intensity and birth satisfaction. Therefore, the present study was conducted to investigate the effects of ice pack application to the sacral area on pain intensity in the active

phase of labor and on birth satisfaction among primiparous women.

Methods

This experimental study was conducted using a two-group randomized controlled clinical trial design. Sample size was determined to be 45 for each group—ninety in total. Eligible participants were conveniently selected from pregnant women who, from October 5, 2017 to March 1, 2018, referred for normal vaginal delivery to the maternity unit of Sina hospital, Kamyaran, Iran. Eligibility criteria were primiparity, an age of 18–35, healthy full-term singleton pregnancy, cephalic presentation of the fetus, cervical dilation of 3–4 centimeters at admission, no skin lesions at sacral area, no cold sensitivity, no history of chronic pelvic pain, and no serious fetal cardiac problem. Exclusion criteria were fetal distress, abnormal labor progress, analgesic use three hours before and during the intervention, oxytocin use during the intervention, and voluntary withdrawal from the study. Sampling was started and performed in successive days after obtaining ethical approval from Tehran University of Medical Sciences, Tehran, Iran (with the code of 1396.2690) and obtaining necessary permissions from Kurdistan University of Medical Sciences, Sanandaj, Iran, and the authorities of Sina hospital and its maternity unit. Selected women were allocated to either a control or an intervention group through permuted block randomization with block size of four. Data were collected using a demographic questionnaire, a numerical rating scale, and the Birth Satisfaction Scale-Revised (BSS-R). Numerical rating scale is a standardized scale for pain assessment with acceptable validity and reliability. This scale has frequently been used in previous studies for pain assessment. BSS-R is also a valid and reliable scale for birth satisfaction assessment. This scale includes ten items which are scored from 0 (“Strongly disagree”) to 4 (“Strongly agree”). Four items are scored reversely. The three subscales of the scale are satisfaction with the quality of care provision (four items),

personal attributes (two items), and stress experienced during labor (four items). A study reported that the Cronbach’s alpha values of the scale and its three subscales were 0.79, 0.74, 0.64, and 0.71, respectively (25). This scale had not been used in Iran before our study and hence, we translated it from English into Persian and then, from Persian into English. Our English version was compared with the original version which showed acceptable similarity. Then, for content validity, ten midwifery faculty members assessed probable ambiguities in the Persian translation. Finally, the Persian BSS-R was applied, in a pilot study, to twenty eligible pregnant women who were not among study participants. The two-week test-retest Pearson’s correlation coefficient and the Cronbach’s alpha of the scale were 0.774 and 0.706, respectively. For the intervention, initially the demographic data of all patients in both groups were collected and their baseline labor pain intensity was assessed using the numerical rating scale. Then, women in the intervention group received cryotherapy in addition to routine care services. For cryotherapy, a plastic bag sized 8-22 centimeters was filled with 250 milliliters of fresh water and placed in freezer at -5°C until ice was formed. Thereafter, the bag was covered with a piece of cotton fabric and placed on the sacral area of each participant in the intervention group in the active phase of labor for ten minutes. This intervention was repeated every thirty minutes up to the beginning of the second stage of labor. During the intervention, women were able to assume their preferred position (sitting, standing, or lateral) and change it at will (24). Women in the control group merely received routine care services which included intravenous line establishment, clothing and sheet change, fluid administration, fetal heart auscultation, vital signs monitoring, uterine contraction monitoring, and periodical vaginal examinations. Pain assessment was repeated for all participants every one hour during the active phase of labor. Moreover, birth satisfaction was evaluated 24 hours after delivery using BSS-R. Data were entered into

the SPSS software (v. 22.0), where between-group homogeneity respecting participants' demographic and clinical characteristics was tested through the independent-sample *t*, Chi-square, and Fisher's exact tests. Moreover, the independent-sample *t* test was performed to compare the groups respecting the pretest and posttest mean scores of labor pain and the posttest mean score of birth satisfaction. The level of significance was set at less than 0.05.

Results

Initially, ninety parturient women were recruited to the study. However, two (one from each group) were excluded due to fetal distress caused by meconium aspiration. These two women gave birth through cesarean section. Therefore, 88 women completed the study.

Most women in the intervention group aged 24 and less (54.5%), while most women in the control group aged 20–30 (52.3%). Most of them in these two groups had a gestational

age in the range of 39 weeks to 40 weeks and six days (61.4% vs. 59.1%). Moreover, most women had moderate economic status and secondary educational level. The groups did not significantly differ from each other in terms of women's demographic and clinical characteristics ($P > 0.05$; Table 1).

For between-group comparisons respecting the variations of labor pain intensity across the six measurement time points, we needed to use the repeated measures analysis of variance. However, the requirements for this analysis were not fulfilled and thus, the independent-sample *t* test was used with Bonferroni's correction. The level of significance was set at 0.004. Results showed that before and one hour after the intervention onset, the groups did not significantly differ from each other respecting the mean score of labor pain intensity ($P = 0.882$ and 0.056 , respectively).

Table 1. Participants' demographic and clinical characteristics

Characteristics	Group	Intervention N = 44	Control N = 44	P value*
Age (Year)	≤ 24	24 (54.5%)	17 (38.6%)	0.35**
	25–30	15 (34.1%)	23 (52.3%)	
	31–35	5 (11.4%)	4 (9.1%)	
Gestational age (Week)	37–38 + 6 days	13 (29.5%)	14 (31.8%)	0/71**
	39–40 + 6 days	27 (61.4%)	26 (59.1%)	
	≥ 41	4 (9.1%)	4 (9.1%)	
Abortion history	No	37 (84.1%)	32 (72.7%)	0/19†
	Yes	7 (15.9%)	12 (27.3%)	
Educational level	Primary and guidance school	8 (18.2%)	12 (27.2%)	0/59†
	High school and Diploma	30 (68.2%)	27 (61.4%)	
	University	6 (13.6%)	5 (11.4%)	
Employment status	Housewife	35 (79.5%)	37 (84.1%)	0/64‡
	Employee	4 (9.1%)	1 (2.3%)	
	Student	1 (2.3%)	2 (4.5%)	
	Self-employed	4 (9.1%)	4 (9.1%)	
Economic status	Low	3 (6.8%)	5 (11.4%)	0/27‡
	Moderate	24 (54.6%)	29 (65.9%)	
	High	17 (38.6%)	10 (22.7%)	

*: Level of significance was set at < 0.05 ; **: The results of the independent-sample *t* test; †: The results of the Chi-square test; ‡: The results of Fisher's exact test

However, at two, three, four, and five hours after the intervention onset, the mean score of labor pain intensity in the intervention group was significantly less than the control group ($P < 0.001$; Table 2).

Respecting the subscales of birth satisfaction, the mean score of the personal attributes subscale in the intervention group was significantly greater than the control group ($P =$

0.03), while between-group differences respecting the mean scores of the other two subscales, i.e. quality of care provision and the stress experienced during labor, were not statistically significant ($P > 0.05$). Moreover, the groups did not significantly differ from each other in terms of the total mean score of birth satisfaction ($P = 0.24$; Table 3).

Table 2. Between-group comparisons respecting the mean scores of labor pain intensity at different measurement time points

Time	Group	Intervention		Control		P value**
		N	Mean±SD	N	Mean±SD	
Before intervention onset		44	2.63±0.613	44	2.65±0.805	0.88
1 hour after intervention onset		44	4.22±0.604	44	4.54±0.901	0.056
2 hours after intervention onset		44	5.40±0.947	44	6.06±0.899	< 0.001
3 hours after intervention onset		43*	6.20±0.803	43*	7.51±1.05	< 0.001
4 hours after intervention onset		40*	7.25±0.926	40*	8.50±0.751	< 0.001
5 hours after intervention onset		8*	8/25±0.707	20*	9.30±0.571	< 0.001

*: Other participants entered the second stage of labor before this time point; **: The results of the independent-sample *t* test (Level of significance was set at < 0.004).

Table 3. Between-group comparisons respecting the mean scores of birth satisfaction

Birth satisfaction	Group	Intervention	Control	P value*
		N = 44	N = 44	
		Mean±SD	Mean±SD	
Quality of care provision		13.9±2.80	13.47±2.38	0.36
Personal attributes		3.02±1.98	2.15±1.75	0.03
Stress experienced during labor		6.81±3.36	6.68±3.20	0.84
Total		23.75±5.83	22.31±5.70	0.24

*: The results of the independent-sample *t* test (Level of significance was set at < 0.05)

Discussion

This study was conducted on ninety parturient women in a control and an intervention group in order to investigate the effects of ice pack application on pain intensity in the active phase of labor and on birth satisfaction among primiparous women. Study findings indicated that although the mean score of pain intensity in both groups increased, the amount of increase in the control group was

significantly greater than the intervention group ($P < 0.001$), denoting the effectiveness of ice pack application in alleviating labor pain. Al-Battwai et al (2017) also evaluated the effects of ice pack on labor pain. They provided women in their control group with routine maternity care and women in their intervention group with ten-minute cryotherapy through placing an ice pack on their lower abdomen and low back for ten minutes in addition to

routine maternity care. They used a visual analogue scale and a behavioral pain scale to evaluate labor pain intensity at four measurement time points, namely before, immediately after, thirty minutes after, and sixty minutes after their intervention. Their findings showed that 35% of women in their intervention group had severe pain at baseline. Immediately and thirty minutes after the intervention, this value decreased to zero, while sixty minutes after the intervention, 20% of women were again in severe pain. In their control group, 58.3% of women had severe pain at baseline, while immediately, thirty minutes, and sixty minutes after the intervention; this value was 72.5%, 50%, and 85%, respectively (26). These findings indicate that ten-minute cryotherapy using ice pack has analgesic effects for only thirty minutes and hence, re-application of ice pack is necessary after thirty minutes. Similarly in the present study, we repeated ice pack application every thirty minutes and found significant between-group differences at two, three, four, and five hours after the intervention onset. Mardliyana et al. (2017) also reported that the application of ice gel for ten minutes on the lower abdomen and low back significantly reduced labor pain intensity (27). Purwaningsih et al. (2015) also compared the effects of warm and cold compresses on pain associated with perineal laceration. For women in the warm and the cold compress groups, they respectively placed a warm water bag for 20–25 minutes and an ice pack for 5–10 minutes on the perineum while women were in the lithotomy position. The interventions were repeated thrice every thirty minutes and pain intensity was assessed before and after each repeat, i.e. six times in total. They finally

reported that both warm and cold compresses significantly reduced pain intensity, while the effects of cold compress were significantly higher than warm compress. Similarly, Abdel Ghani (2014) applied a warm water bag for fifteen minutes to the lower abdomen and low back and then, applied ice pack on the Hugo (L14) acupoint for five minutes for parturient women. She repeated this intervention every one hour up to full cervical dilation and assessed labor pain intensity immediately after the intervention and also at the time points of six- and eight-centimeter cervical dilation. She found that the intervention was effective in significantly reducing labor pain intensity at all three measurement time points (28). These findings are in line with the findings of the present study. Gnaji et al. (2013) also assessed the effects of thirty-minute application of warm water bag followed by ten-minute application of ice pack on the lower abdomen and low back with several repeats every thirty minutes. They reported the effectiveness of their intervention in significantly alleviating labor pain in the acceleration, maximum slope, and deceleration phases and the second stage of labor (29). All these findings, together with the findings of the present study, indicate that maintaining the continuity of cryotherapy is essential for significant labor pain alleviation. Our findings showed that the mean score of birth satisfaction in the intervention group was slightly greater than the control group; however, this difference was not statistically significant. Contrarily, Al-Battawi et al., who evaluated women's birth satisfaction using a birth satisfaction visual scale, found that 55% of women in their ice pack group were highly satisfied with birth experience, while 62.5% of women in their control group were dissatisfied

with birth experience. Moreover, the mean score of birth satisfaction in their intervention group was significantly higher than their control group (26). Abdel Ghani (2014) also reported significantly greater birth satisfaction in the intervention group of her study (28). This contradiction may be due to the difference between the studies in terms of the time of satisfaction assessment. For instance, Abdel Ghani (2014) assessed birth satisfaction immediately after delivery (28), while we assessed birth satisfaction 24 hours after delivery.

One study limitation was individual differences among participants respecting their pain thresholds. The other limitation was related to the effects of women's emotions and feelings on their self-reported labor pain intensity and birth satisfaction.

This study shows the effectiveness of ice pack application to the sacral area in significantly reducing pain intensity in the active phase of labor. Therefore, midwives and parturient women can use this simple, inexpensive, and easily accessible and applicable technique for labor pain alleviation.

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