

## Original Article

# Comparison of separate and intermittent heat and cold therapy in labour pain management

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## ABSTRACT

**Background & Aim:** Although cold and heat have been recommended for labor pain relief, comparison of them and intermittent change in cold and heat therapy has been less considered. This study compared the effects of separate and intermittent heat and cold on labor pain relief and some birth outcomes.

**Methods & Materials:** This was a randomized clinical trial. Ninety-six parturient women were randomly allocated to three groups. The heat therapy group received warm water bags and the cold therapy group received ice bags over abdomen, lower abdomen and low back, intermittently based on mother's preference, in the first stage and also over perineum in the second stage of labor. In the intermitted heat and cold group, a warm water bag was used followed by an ice bag during the active phase, and the second stage. Pain severity was assessed by a visual analogue scale. Duration of labor, mothers' satisfaction and fetal and neonatal outcomes were assessed. Mean, standard deviation, frequency, Chi-square, ANOVA and repeated measurement were used for data analysis.

**Results:** Although pain intensity was slightly lower in the heat therapy group during labor, it was not significantly different between three groups. The duration of the second stage was significantly lower in the cold therapy group ( $p=0.02$ ). There were not significant differences in duration of the first and third stages, fetal heart rate and Apgar score between the groups. Mothers' satisfaction was high in 56.2% of the heat and the intermittent heat and cold therapy groups compared to 37.5% in the cold therapy group ( $p>0.05$ ).

**Conclusion:** To provide pain relief during labour, application of heat and cold, either separate or intermittent can be used based on the mother's preference.

## Introduction

Labour pain is a great worry for the mother and her family. Experience of severe labour pain affects women's attitudes about vaginal birth. In addition, women tell their negative birth experiences to the other mothers, which may spread fear of labour and increase requests for caesarean (1). There is a vicious circle between pain and fear, so they exacerbate each other (2, 3). On the other hand, severe pain induces undesirable systemic effects (4). Pain increases the levels of circulating catecholamine by

inducing a physiological stress response. Increased epinephrine levels may result in prolonged labour through uterine relaxation, which is mediated by beta receptors (4-6). The second stage is associated with new senses of pain and fear that decrease the mother's participation (7). Because labour pain has a great effect on intra partum care and birth outcomes (8), relief of pain by safe and effective methods is an important aspect of maternal care. There is a growing trend to non-pharmacological pain relief methods because of low potential risks for mother and fetus. These methods also lead to higher satisfaction from the birth experience by increasing the sense of control and empowerment (8).

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Cold and heat therapy, as a sensory intervention for pain relief, have been used for many years (9, 10). In 210 maternity units in the UK, 21% applied cold packs and 33% applied warm packs for pain relief during the second stage of labour on a regular basis, and the others used them occasionally (10). In one study, 28% of 41 women who were taught about application of hot/cold therapy used these strategies, and six women found them very effective pain relief techniques (9).

Some studies showed heat therapy is effective on the relief of labour pain (7, 11-14); and only one study reported the effectiveness of cold therapy (15). However the efficacy of these methods wasn't compared in these studies. In addition the effect of these methods may be different in various conditions, e.g. cold therapy induces more relief than heat therapy in acute lower back pain and perineal pain after episiotomy (16, 17). On the other hand, it is thought that changes in stimulus may give more relief, so cold alternated with heat was recommended (16, 18). However, there are not enough evidences about intermittent heat and cold therapy for labour pain. Furthermore, application of heat and cold together and alone for relief of labour pain has not been compared until now. For these reasons, there is a lack in knowledge about application of heat and cold therapy in maternity units yet.

The aim of this study was to compare the effect of separate and intermittent heat and cold on labour pain. In addition, some of the labour outcomes were compared between the groups.

## Methods

This randomised clinical trial with a parallel design was performed in two maternity units in the north of Iran.

According to the mean of pain intensity in previous study,  $\mu_1 = 9.65 \pm 1.99$ ,  $\mu_2 =$

$8.25 \pm 1.39$ ,  $\alpha = 0 / 05$  and  $\beta = 90\%$  sample size was calculated 32 for each group (11). Ninety-six parturient women were randomly allocated by numbered cards to cold, heat and alternating heat and cold therapy groups. Randomization was stratified according to rupture of membranes (intact and rapture) and body mass index ( $BMI < 19.8$ ,  $19.8-25$  and  $> 25$ ). Recruitment was carried out at any time of day, when eligible parturient women were admitted to the labour unit. Null parity, candidate for vaginal birth, age of 18-35 years, gestational age of 37-41 weeks, single pregnancy, cephalic presentation, spontaneous onset of active phase, no history of psychiatric and chronic medical problems, no dermatologic problems in abdomen and low back and no complications of pregnancy such as gestational hypertension, decrease of fetal movement, fetal growth restriction, fetal death and abnormal fetal heart rate were inclusion criteria. Exclusion criteria included vaginal bleeding, abnormality in fetal heart rate and need to cesarean due to occurrence of any problem during labor.

The Ethical Committee of Mazandaran University of Medical Sciences approved the study protocol (code: H-89-26). IRCT registration number is 201108277422N1. All eligible parturient women completed an informed consent sheet before enrolment in the study. In addition to the purpose of study, it was explained to participants in the information sheet that they were free to leave the study, whenever they wanted and their personal information was kept confidential .

Pain relief was started in each group from the beginning of the active phase. The heat therapy group received a warm water bag at a temperature of 38-40°C, covered with a towel on their abdomen, lower abdomen and lower back, intermittently based on mother preference, in the first stage, and also perineum in the second stage throughout

contractions. In contrast with cold, heat has an immediate and short time effect. Thus the duration and repetition was related to contractions. (12, 13). In the cold therapy group, an ice bag covered by a towel was put over the back, abdomen and lower parts of the abdomen for 10 minutes from the onset of the active phase and repeated every 30 minutes. In addition, an ice bag was put over the perineum during the second stage of birth for 5 minutes every 15 minutes in the cold therapy group. The intervals were selected based on the minimum time for initiation of the cold effect (5-10 minutes) and duration of its effect (19, 20). In the alternate heat and cold group, a warm water bag was put on the abdomen, lower abdomen and lower back for half an hour throughout contractions. Afterwards, the women received an ice bag on the same parts for 10 minutes. This process was repeated after 30 minutes. During the second stage of birth, the times were decreased to half, so a warm bag was put on the perineum for 15 minutes followed by an ice bag for 5 minutes (12, 13, 20, 21). The size of bags was 25 × 15 cm for abdomen and lower back and 15 × 10 cm for perineum. A trained midwife controlled the temperature of bags with a laboratory thermometer (AMARELL) and replaced them for the next time. A midwife did routine care in the all groups, such as control of fetal heart rate and uterine contractions. Vaginal examinations were performed based on labour progression, almost every one hour.

A questionnaire was used for recording demographic and obstetrics information, and mothers' satisfaction. Cronbach's alpha for assessment of reliability was 0.96. Data were collected by interview and reviewing the record files. A trained midwife also recorded the duration of labour stages, obstetric interventions, maternal, fetal and neonatal outcomes such as Apgar in sheets for each groups. A five-point Likert question

evaluated women's satisfactions about labour experience at the end of delivery. For this purpose, the mothers were asked "how satisfied are you with process of your delivery?" Pain severity was assessed by a visual analogue scale (VAS). A horizontal line, 100 mm in length, defined by descriptive words of "no pain" and "very severe pain" at each end was used. Using the pain VAS, participants are asked to put a mark on the line, where they felt represents the most severe pain that they experience. The VAS has been reported a valid and reliable measure of pain intensity with correlation coefficient of 0.79-0.96 in comparison with other common pain measures and  $r = 0.71-0.94$  with test-retest (22, 23). In this study, a trained midwife asked women to show the severity of pain on a VAS at the beginning of the active (dilatation of 3-4 cm), acceleration (dilatation of 5-6 cm), maximum of slope (dilatation of 7-8 cm) and deceleration (dilatation of 9-10 cm) phases and the second stage of labour .

We used mean, standard deviation, frequency, Chi-square, ANOVA and repeated measurement for data analysis. The statistical significance was considered when the p value was less than 0.05.

## **Results**

After exclusion of 27 women as per the exclusion criteria, 96 parturient women including 32 cases in each group were compared (Figure 1). The differences of demographic and obstetrics variables were not significant between groups (Table 1.)

Pain intensity was not significantly different at the onset of the active phase and other phases of labour between groups. The pain was slightly lower in the heat therapy group compared to other groups during labour (Table 2). According to repeated measurement there was no significant interaction between pain intensity and type

of intervention by time. It means that the effect of pain relief methods was not different during the time between groups.

The comparison of labour duration showed a significant difference between study groups only in the second stage ( $p < 0.02$ ). This difference was significant between heat and cold therapy by the Scheffe test (Table 3). The mean fetal heart rate was  $139.97 \pm 5.98$  in the heat therapy,  $140.53 \pm 5.41$  in the cold therapy and  $140.56 \pm 5.55$  in the

intermittent heat and cold group, but the differences were not significant. Apgar score was not significantly different between these groups ( $8.90 \pm 0.39$ ,  $8.75 \pm 0.56$  and  $8.81 \pm 0.47$ , respectively).

The majority of women in the heat and intermittent heat and cold therapy groups had high satisfaction of the labour process (56.2%), but most of the cold therapy group had moderate satisfaction (53.1%) and just 37.5% were highly satisfied ( $p > 0.05$ ).

**Table 1.** Demographic and obstetrics variables in the study groups

Demographic and obstetrics variables	Heat therapy M $\pm$ SD <sup>†</sup>	Cold therapy M $\pm$ SD <sup>†</sup>	Heat and cold therapy M $\pm$ SD <sup>†</sup>	P-value
Age (year)	27.46 $\pm$ 5.41	28.53 $\pm$ 5.41	28.81 $\pm$ 5.52	0.58
BMI (Kg/m <sup>2</sup> ) ‡	25.63 $\pm$ 4.31	26.55 $\pm$ 7.71	24.74 $\pm$ 3.81	0.38
Gestational age(week)	38.93 $\pm$ 0.84	39.09 $\pm$ 0.85	39.06 $\pm$ 0.84	0.73
Neonate weight (gr)	3400.00 $\pm$ 246.58	3387.50 $\pm$ 247.24	3403.12 $\pm$ 237.57	0.96
Membranes	rupture	11 (28.9%)	12 (31.6%)	0.80
	intact	21 (36.2%)	20 (34.5%)	

<sup>†</sup>Mean  $\pm$  Standard Deviation, <sup>‡</sup>body mass index

**Table 2.** Comparison of pain intensity based on the visual analogue scale (VAS) during labour between the study groups

Labor phases	Pain intensity			P-value
	Heat therapy M $\pm$ SD <sup>†</sup> (CI%95) ‡	Cold therapy M $\pm$ SD <sup>†</sup> (CI%95) ‡	Heat and cold therapy M $\pm$ SD <sup>†</sup> (CI%95) ‡	
Basic	6.93 $\pm$ 2.03 (6.20-7.66)	6.81 $\pm$ 1.92 (6.11-7.50)	6.84 $\pm$ 1.93 (6.14-7.54)	0.96
Acceleration	5.21 $\pm$ 1.58 (4.64-5.78)	5.53 $\pm$ 1.34 (5.04-6.01)	5.50 $\pm$ 1.36 (5.00-5.99)	0.63
Maximum of slop	5.78 $\pm$ 1.49 (5.24-6.32)	6.09 $\pm$ 1.55 (5.53-6.65)	6.18 $\pm$ 1.51 (5.64-6.73)	0.53
Deceleration	6.03 $\pm$ 1.61 (5.44-6.61)	6.21 $\pm$ 1.47 (5.68-6.75)	6.34 $\pm$ 1.45 (5.82-6.86)	0.70
Second stage	6.28 $\pm$ 1.54 (5.72-6.84)	6.50 $\pm$ 1.64 (5.90-7.09)	6.59 $\pm$ 1.64 (6.00-7.18)	0.73

<sup>†</sup>Mean  $\pm$  Standard Deviation,

<sup>‡</sup>95% Confidence interval for mean

**Table 3.** The comparison of the duration of labour stages between the study groups

Labor stages	Duration of stages(min) <sup>§</sup>			P-value
	Heat therapy M±SD <sup>†</sup> (CI%95) <sup>‡</sup>	Cold therapy M±SD <sup>†</sup> (CI%95) <sup>‡</sup>	Heat and cold therapy M±SD <sup>†</sup> (CI%95) <sup>‡</sup>	
First stage	190.75±75.36 (163.57-217.92)	190.44±60.90 (168.47-212.39)	201.22±64.86 (177.83-224.60)	0.76
Second stage	41.71±14.63 (36.44-46.99)	32.12±10.60 (29.30-36.94)	39.50±12.28 (35.07-43.92)	0.02
Third stage	4.50±0.98 (4.14-4.85)	5.25±2.30 (4.42-6.07)	5.31±2.20 (4.51-6.10)	0.17

<sup>§</sup>minute, <sup>†</sup>Mean ± Standard Deviation

<sup>‡</sup> 95% confidence interval for mean

## Discussion

Based on the results, the effect of heat and cold on the reduction of labour pain was not significantly different. Also, alternating the sensory stimulus by heat and cold was not more effective than each other separately. According to Curcuvik and Vitulic's study, pain threshold raised with both heat and cold in patients with rheumatoid arthritis. There were no significant differences in the pain threshold between warm bath and ice massage groups. Of course, the cold effect was longer than the heat (21). Also, a cross over study considered perineal pain and the reported distress score was not different following both cold and warm bath (24). In the above studies, the form of heat and cold therapy and type of pain was different from the present study, but the results were similar and no difference was seen between the effect of heat and cold. Although some older studies reported that cold was more effective than heat in reducing episiotomy pain (17, 20). A reason for different results may be due to various techniques such as temperature, duration and form of intervention. As in a review by East et al., the perineal pain was significantly less with an ice pack, but not with a cold gel pad (25). It seems that the form of cold or heat can influence the outcomes. In the present study, the same form of heat and cold was used,

thus more investigations are needed for comparison the effect of various forms of heat and cold.

Of course, most studies have not compared the relieving effect of heat and cold. Dahlen et al. reported a relief in perineal pain in the second stage of labour by the application of a warm pack (7). Behmanesh et al. reported a significant difference in labour pain between heat and control groups in the first and second stage (11). Recent investigations have showed the effect of heat in various forms in reducing labour pain and rise in mothers' satisfaction (12-14). According to another report, labour pain was decreased by a cold pack (15). It was also reported the intermittent heat and cold therapy effectively decreased labour pain compared to the control group (18). Some mechanisms for effectiveness of heat/cold include: providing stimuli from peripheral sensory receptors to inhibit pain awareness, anti-nociceptive effects on the gate control system, decreasing muscle tension and distraction of attention from pain (19, 26, 27).

Khamis et al. reported that heat increases uterine activity and so decreases the duration of labour without abnormal changes in fetal heart rate (28). Although pain relief and cervical dilatation were greater with a warm tub bath, the differences were not significant, as well as vaginal or perineal

laceration, total duration of labour and new born condition (29). Some others showed warm water immersion decreases the duration of labour phases (30-32). In another study duration of the first and third stages of labour decreased significantly in the heat group compared with the control group (11). However, in this study, the duration of labour was significantly different between groups only in the second stage, which was the shortest in the cold group. It seems that the effect of cold on duration of labour is more than heat. Of course in the above studies the effect of heat and cold on duration of labour was not compared. On the other hand, in this study, we used dry heat, but in the most of studies wet heat was used. So water immersion is a confounding factor that may affect the results. Similar to what was said about pain intensity, different results about the duration of labour may be due to the method of heat/cold therapy used .

It seems most of the mothers in this study preferred heat, because majority of them had high satisfaction in the heat and alternate heat and cold group, whereas most of the mothers in the cold group had moderate satisfaction. Of course, the type of heat/cold therapy may affect the satisfaction. In a review, East et al. reported women were more satisfied with use of cold gel pads than ice packs. Mothers' satisfaction must be considered for selection of a pain relief method (25).

Application of superficial heat and/or cold to manage labour pain is a convenient, effective and inexpensive method with rare side effects, and does not require highly skilled care. Both heat and cold provide relief and comfort, and should be used by desire and the preference of women. Superficial heat and/or cold therapy provide active participation of women in the birthing process, and promote a more positive birth experience.

Some limitations of present study were: blinding was not done because all of women were hospitalized in one labor room and comparison of various forms of heat and cold such as wet heat and wet cold were not performed because it was not the aim of this study. Thus future studies including placebo control group are needed. Also assessing the effect of maternal and fetal variables on labor pain is suggested.

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### **Conflict of Interest**

The authors declare that they have no conflicts of interest

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