Effect of Heat and Cold Therapy during the First Stage of Labor on Women Perception of Birth Experience: A Randomized Controlled Trial

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Abstract

This study aimed to determine the effect of heat and cold therapy during the first stage of labor on women perception of birth experience. Design: Randomized controlled trial. Setting: This study was conducted at Qasr al-Aini, Cairo University maternity hospitals at labor and delivery unit. Sample: One hundred parturient women were recruited randomly and allocated to the study and the control groups, fifty for each. Inclusion criteria were primigravida, nulliparous women, age between 18 to 35 years, gestational age between 37 to 41 weeks, single fetus, cephalic presentation, and on the active phase of labor (3 cm dilatation). Data collection tools included; 1) a structured interview questionnaire, 2) labor and delivery assessment sheet, 3) Visual Analogue Scale for pain intensity, 4) Visual Analogue Scale for maternal satisfaction, 5) State Anxiety Inventory, and 6) Crashed ice and hot rubber packs. Intervention: During the first stage of labor at 3 cm cervical dilatation, women of the study group received hot water pack with a temperature of 38-40°C. covered with cotton towel on their lower abdomen, and low back for 15 minutes on left side-lying position, then they received crashed ice pack covered with thin cotton towel in both hands, between thumb and forefinger, (LI4) acupressure point for 5 minutes. Results: There were significant statistical differences between both groups after intervention. Mothers in the study group reported lower mean pain score of 5.78±0.73 SD, lower mean anxiety score of 32.92±3.72 SD and higher satisfaction level with mean of 6.40±0.53 SD than mothers in the control group (P ≤0.05). Conclusion & recommendation: Heat and cold therapy is an inexpensive and is particularly empower woman's birth experience. Further randomized controlled trials are needed for best evidence.

Keywords: Heat, ice, first stage of labor, birth experience, randomized trial.

Introduction

Natural childbirth is a beautiful experience with many safe options and benefits. Comfort is an interesting concept in the context of childbirth pain. The feeling of comfort is the expression of having impeding needs or desires in three domains; body, mind and spirit (Foponide and Kuti, 2004). If we discovered that the birth experience has an impact on one's mental health or psychological well-being, it would make sense to seek and use interventions that exert positive influences (Waldenström, etal. 2004). A positive birth experience helps to increase mother-child bond, and contributes to her sense of accomplishment and self-esteem (Beck, 2004). In contrast, a negative birth experience make the mother feel distraught and has a negative impact on her mental health, increases the risk of postpartum depression and post-traumatic stress disorder (Tarkka, etal. 2000). When women evaluate their experience, four factors predominate; the amount of support from caregivers, the quality of relationships with caregivers, being involved with decision-making and having high expectations or having experiences that exceed expectations (Lowe, 2002; Hodnett, 2002). Severe pain could result in exacerbation of mother's fear and anxiety during delivery and may prevent mother's satisfaction (Sercekus & Okumus, 2007). Administration of drugs might not only cause side effects but also can disturb mother's active cooperation during delivery (Cunningham, etal. 2010). Many simple, effective, methods to relieve labor pain can be initiated by benefits of improved labor progress, reduction in use of riskier medications and increase satisfaction (Lowe, 2002). One of non-pharmacological methods of relieving labor pain is administration of heat and cold in various patterns. The effects of discrete heat and cold on decreasing labor pain have been reported but no randomized clinical trial has been performed about the effect of simultaneous heat and cold except one randomized controlled trial (Ganji, Shirvani & Danesh, 2013). Cold is best for acute pain, numbing painful areas and decreasing inflammation. While heat improves blood flow, muscles relaxation and soothes throbbing pain (Simkin & Bolding, 2004). Caregivers have a great deal of influence on how each woman will remember her experience. In addition to a safe outcome, the goal of a good memory should guide their care.

Materials and Methods

Aim

To determine the effect of heat and cold therapy during the first stage of labor on women perception of birth experience.

Hypotheses

1- Parturient woman who receive hot and ice packs applications during the first stage of labor will has lower pain level than those who don't.

2- Parturient woman who receive hot and ice packs applications during the first stage of labor will has lower anxiety level than those who don't.

3- Parturient woman who receive hot and ice packs applications during the first stage of labor will has higher satisfaction with birth experience than those who don't'.

Design

Randomized controlled trial.

Setting

This study was conducted at Qasr al-Aini, Cairo University maternity hospitals, at labor and delivery unit.

Sample

One hundred parturient women were recruited randomly and allocated to the study and the control groups, fifty for each. The inclusion criteria were primigravida, nulliparous women, read and write, age between 18 to 35 years, gestational age between 37 to 41 weeks, single fetus, cephalic presentation, and on the active phase of labor (3 cm dilatation). Women with chronic diseases, dermatologic disorders, history of any complications during pregnancy and received pain killer medications were excluded. The sample size has been determined based on the daily numbers of admission into the labor and delivery unit.

Tools and measurements

Data collection tools included the following; 1) a structured interview questionnaire, 2) labor and delivery assessment sheet (Partograph), 3) Visual Analogue Scale for pain intensity, 4) Visual Analogue Scale for maternal satisfaction, 5) State Anxiety Inventory, and 6) Crashed ice and hot rubber packs.

1) A structured interview questionnaire. In order to present the socio-demographic data.

2) Labor and delivery assessment sheet (Partograph). Partograph is a valid graphic representation of the event of labor progress plotted against time (World Health Organization, 1994). It includes three main sections; maternal condition, labor progress and fetal condition.

3) Visual Analogue Scale for pain intensity (Huskisson, 1974). The VAS is a 10-cm line marked from 0 (no pain) to 10 (pain as bad as can be). The respondent was asked to mark between the two extremes that best described the degree of pain intensity being experienced at that moment. The VAS possesses both concurrent validity and discriminant validity (Gift, 1989). The test-retest reliability coefficient of the VAS has been demonstrated as r =0.71 (Reville, etal. 1976).

4) *Visual Analogue Scale for maternal satisfaction.* This scale ranked as no satisfaction (zero), *mild satisfaction (1-3.5 cm), moderate satisfaction (4-7.5),* and *high satisfaction (8-10cm).* The validity was determined using content validity, and the reliability of the VAS was determined using equivalence testing. The correlation coefficient was 0.94 *(*Brokelman, etal. 2012).

5) State Anxiety Inventory (SAI) is a subscale of the State Trait Anxiety Inventory, measure one's anxiety at that moment in time. It is characterized by subjective feelings of apprehension, nervousness, and worry (Spielberger, 1983). The instrument contains 20 questions, 10 represent anxiety-present items and the rest represent anxiety absent items that are answered using a four-point Likert scale. The responses range from not at all to very much so. The least anxiety possible is a score of 20, whereas the greatest anxiety is a score of 80, after reverse coding of anxiety-absent items. A cut point of 39 – 40 has been suggested to detect clinically significant symptoms for the state-anxiety scale (Abed & Hall, 2011). The inventory was translated into Arabic for the study purpose. The content validity was examined by psychiatric experts (n=3). While the test-retest reliability was r =0.90. Further, the internal consistency was demonstrated by the alpha coefficient that ranged from 0.82 to 0.93.

6) Crashed ice and hot rubber packs.

Recruitment of participants and randomization

An official permission was obtained from the administrative authorities of Qasr-al Aini maternity hospital of Cairo University for conducting this study. Identifying the random sample was done on the admission of women through the following three steps; *First,* identifying total number of women who admitted in labor and delivery unit in one day from admission registration notebook. Then determining the hospital numbers wrote on the main admission paper. *Second,* limiting the number of mothers in term of who were met the inclusion criteria. *Third,* ordering the hospital numbers, woman who had an even number on her admission paper was included in the study. While random assignment to the study and the control group achieved by withdraw the sealed envelopes contain numbers from one to one hundred. Formal consent was signed ensuring that all data obtained were to be

strictly confidential.

Implementation

The present study grounded by the Gate control theory which proposed by Melzack and Wall (1965) and Roy's adaptation model (1976). The gate control theory suggests that pain impulses can be regulated or even blocked by gating mechanism. While Roy's model, defined a person as is a bio-psycho-social, who uses innate and acquired mechanisms to adapt.

An interview was approached on admission for the demographic information, mother's obstetric history and getting the baseline data, it spent approximately fifteen minutes for each participant. During the first stage of labor at 3 cm cervical dilatation, mothers of the study group received hot water pack with a temperature of 38-40°C, covered with cotton towel on their lower abdomen, and low back (S1-S5) for 15 minutes on left side-lying position throughout the contractions (Ganji, etal. 2013). Then, they received crashed ice pack covered with thin cotton towel in both hands, between thumb and forefinger on LI4 acupressure point for 5 minutes (Fleoy, etal. 2012). This process repeated for 20 minutes every an hour (i.e. in order to allow the tissue to return to normal body temperature) up till full cervical dilatation. Throughout the rest period between each application, mothers were asked to take the appropriate position for them. Pain was assessed just before the intervention at the time of 3cm cervical dilatation, immediately after intervention, at 6cm and 8cm cervical dilatation. While anxiety level assessed before the intervention and at 8 cm cervical dilatation. Mothers' satisfaction levels were assessed immediately after delivery. Mothers in the control group received the standard hospital care.

Results

Statistical package for the social science (SPSS) was used for data statistical analysis.

Characteristics of mothers among the study and the control groups.

Regarding sample characteristics, data denoted that, all mothers were primigravida, nullipara. There were no statistical differences between groups related to age, gestational age and educational level (P≥0.05). The age ranged between 18-35 years old. While gestational age ranged between 37-41 weeks. Most of sample had preparatory and secondary education (table 1).

Table 1. Characteristics of mothers among the study and the control groups.

Items	Study group (n=50)		Control group (n=50)			
	Mean	**SD**	**Mean**	**SD**	**t**	**P**
Age	25.36	4.51	24.44	3.95	1.08	0.28
Gestational age (weeks)	38.88	1.06	39.04	1.17	- 0.71	0.47
Education level						
	No.	**%**	**No.**	**%**	χ^2	**P**
Read & Write	10	20.0	9	18.0	0.06	0.79
Primary School	6	12.0	7	14.0	0.08	0.76
Preparatory School	16	32.0	15	30.0	0.04	0.82
Secondary School	11	22.0	13	26.0	0.21	0.64
University	7	14.0	6	12.00	0.08	0.76

Level of significance at p ≤0.05.

Comparison between both groups before and after intervention.

Regarding pain scores and anxiety levels before the intervention, data denoted that there were no significant statistical differences between groups. Mothers among both groups reported mild labor pain and anxiety level. While after intervention, although pain scores among the study group gradually increased to reach moderate level at 8cm cervical dilatation, there were significant statistical differences between groups (P≤0.05). Further, it was noticed that, the anxiety level increased among both groups compared with the baseline reading. But still there were positive significant statistical differences between groups in favor of the study group. Moreover, mothers among both groups reported moderate satisfaction level of their birth experience with statistical differences in favor of the study group (t=4.94, P≤0.0001). Finally, there were no significant statistical differences between both groups related to the first and the third stage labor duration (P≥0.05), (table 2).

Table 2. Comparison between both groups before and after intervention.

Items	Study group (n=50)		Control group (n=50)		t	P
	Mean	SD	Mean	SD		
Baseline assessment						
Pain score	2.98	0.65	3.00	0.63	-0.15	0.87
Anxiety score	26.74	5.80	27.64	6.28	-0.74	0.45
Assessment after intervention						
Pain immediately after intervention	2.76	0.51	3.00	0.63	-2.06	0.04
Pain at 6 cm cervical dilatation	3.70	0.64	4.14	0.57	-3.60	0.0001
Pain at 8 cm cervical dilatation	5.78	0.73	6.22	0.61	-3.24	0.002
Anxiety score	32.92	3.72	34.38	3.47	-2.02	0.04
Maternal satisfactions	6.40	0.53	5.76	0.74	4.94	0.0001
Labor stages duration						
First stage (3-10cm)/ hours	6.72	1.31	6.94	0.94	0.94	0.34
Second stage / minutes	45.06	4.17	46.93	5.21	-1.94	0.05
Third stage/ minutes	6.68	1.68	7.10	1.98	-1.14	0.25

Level of significance at $p \leq 0.05$.

Discussion

Methodological considerations

Heat has short and immediate effect on pain relief and at least 20 minutes lying in warm water improves labor process (Moneta, etal. 2001; Curkovic, etal. 1993). On the other hand, the effect of cold is prolonger and increases pain threshold after 5 to 10 minutes (McCaffery, 1999; Curkovic, etal. 1993). Based on this information, the protocol of intervention was set. Further, all mothers in the present study were primigravida, nullipara in order to identify the actual effect of the intervention. Parity is a predictor of higher maternal satisfaction, preceding births can offer some preparation for a subsequent one (Jackson, etal. 2001).

Results discussion

One of the methods for relieving labor pain is utilization of heat or cold. Results of the present study denoted that hot and ice packs applications could significantly reduce labor pain. Pain relief with ice application could be due to many mechanisms including inhibition of nociceptors, a reduction in muscle spasm and/or a reduction in metabolic enzyme activity level or via the analgesic descending pathway of the central nervous system such as endorphins (Airaksinen, etal. 2003; Arendt‑Nielsen & Sumikura, 2002). On the other hand, increasing the temperature of the skin/soft tissue lead to improve blood flow. The effect of heat on pain is mediated by heat sensitive calcium channels. Heat generates action potentials that increases stimulation of sensory nerves and causes the feeling of heat in the brain. Once calcium channels activated, they can inhibit the activity of pain receptors (Holowatz, etal. 2005).

Grant (1964) advocated massage with ice for the treatment of musculoskeletal pain and named his technique cryokinetics. Marshall (1971) published a study using ice cube massage for the relief of chronic pain of eye herpes. Melzack (1983; 1980) found that intense sensory input produced by ice massage of the web between the thumb and forefinger resulted in a fifty percent reduction in acute dental pain. The researchers hypothesized that the efficacy of ice massage was due to engaging the gate control pain system rather than eliminating the source of the pain (Melzack & Wall, 1965). The present result is congruent with other studies' results those confirmed that, ice massage on Hugo point (LI4) during contractions help in reduction of labor pain at the beginning of labor (Fleoy, etal. 2012; Nunes & Vargens, 2007; Waters & Raisler, 2003; Waters, 1992). On the other hand, analysis of 210 labor departments in Britain demonstrated that midwives had used hot packs for reduction of labor pain during the second stage of labor in 33% of the parturient women and cold packs in 21% of them (Allaire, 2007; Sanders, etal. 2005). Regarding the effects of heat on labor pain, Cluett, *etal.* (2004) reported that labor pain during the three stages of labor in women who were put in warm water was less than women who received routine care. Geissbuhler, *etal.* (2004) evidenced that necessity of obstetrical anesthetics during delivery in warm water was less than routine delivery and warm water had decreased labor pain in 69% of the cases. While Grodzke, *etal.* (2001) reported that, delivery in warm water led to decrease labor pain in 76% of the cases. However, in those three studies, they have used floating in warm water instead of local warm water, but there are also reports of utilizing local warm water with beneficial effects. Fahami, etal. (2011) and Behmanesh, *etal.* (2008) demonstrated that application of local warm water during the first (*P*<0.01) and the second stages (*P*<0.001) of labor might decrease pain intensity. While, Taavoni, *etal.* (2011) used warm towel on sacral and perineum area and achieved beneficial effects on labor pain.

Additionally, the present study revealed that, mothers in the study group reported lower anxiety level after intervention than mothers in the control group, although the anxiety level among the study group increased than the baseline level. We can refer this result to the application of the pain relief method. When the mothers felt that they could overcome the sensation of pain, their anxiety level consequently decreased. Concerning the effect of cold on decreasing anxiety, it appears that, cold can effectively decline catecholamine level and therefore raise endorphin level, block the neural transmission in sensory fibers and elevate pain threshold (Allaire, 2007). In addition, heat may stimulate heat receptors in derma, deeper tissues and different impulses neutralize themselves and subsequently impede neural pain impulses to reach the brain (Habananda, 2004). The present study result go on the same line with other studies' results which revealed that anxiety correlated significantly with labor pain expectancies (Mortazavi, etal. 2012; Cruzik & Jokic-Begic, 2011; Chang, etal. 2002).

Further, the present study's result revealed that, mothers in the study group had shorter second stage duration than mothers in the control group. We can explain this result as, mothers in the study group may experience sense of control that is effective in labor progression. Increasing endorphin and oxytocin may lead to appropriate uterine contractions and shorter second stage duration. This result goes on the same line with Behmanesh, etal. (2008) who reported that, heat can improve the local blood circulation and therefore increase the number, duration, and intensity of uterine muscle contractions. On the other hand, this result goes on the opposite line with the result of Ganji, etal. (2013) who demonstrated significant differences in duration of the first and the third stages of labor as they were shorter in the heat and cold group.

Moreover, mother's satisfaction during the birthing process is the most frequently reported indicator in the evaluation of the quality of maternity services (Goodman, etal. 2004). Result in the present study denoted that, the study group mothers had moderate satisfaction level related to their labor experience. We can refer this result to the perceived sense of control and empowerment. The meaning of being in control seems to have many dimensions that are not easily distinguished from one another. Self control or behaving in a planned, prescribed manner during contraction was one dimension. For women in the present study, control meant remaining relaxed and quite. They took great satisfaction not only in avoiding pain medications, but also in appearing not to be in pain. The present result consistent with other studies those recommended different non-pharmacological pain relief methods to promote high satisfaction (Ganji, etal. 2013; Hodentt, 2002; Brown, etal. 2001).

Conclusion
Heat and cold therapy is an inexpensive, simple, safe, and effective non-pharmacological pain relief method. And is particularly empower woman's birth experience.

Recommendations
Further randomized controlled trials are needed for best evidence. An in service education program can be organized for updating nursing practice in delivery unit.

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