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Original Article

Cabbage compression early breast care on breast engorgement in primiparous women after cesarean birth: a controlled clinical trial

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Abstract: This study aimed to compare the effects of cabbage compression early breast care (CCEBC) and early breast care (EBC) on breast pain, breast hardness with general nursing breast care (GNBC) in primiparous women after cesarean birth. Sixty participants were divided to three groups including CCEBC, EBC and GNBC. Each group was treated with its intervention respectively more than 10 minutes before breast feeding from day two to day four after delivery. The primary outcomes were breast pain and breast hardness. Both CCEBC and EBC showed significantly lower pain level than GNBC at day 4 after delivery. There are significant differences of breast hardness among three groups. CCEBC group showed significantly lower breast hardness compared with EBC and GNBC. Neither core body temperature nor breast skin temperature was significantly different among the three groups. In conclusion, CCEBC may effective in relieving breast pain and breast hardness compared with EBC alone and GNBC in primiparous women after a cesarean birth.

Keywords: Cabbage compression, breast care, cesarean birth, breast pain, breast hardness

Introduction

The breast-feeding rate in South Korea started to decline in 1970 and reached its lowest level (10.2%) in 2000. Over the last 10 years, the rate has increased; the rate was 16.5% in 2003 and 24.2% in 2006 [1]. However, the rate is still lower than that in developed countries.

Breast-feeding is beneficial to newborn babies, infants, and mothers. Breast milk contains optimal nutrients that are necessary for the growth of babies as well as immunological ingredients that can protect babies from bacterial infections. In addition, the secretion of oxytocin, a hormone that causes uterine contractions and reduces postpartum bleeding, is facilitated by breast-feeding. Breast-feeding reduces postpartum depression and enhances the attachment between the mother and the baby. This practice also has economic benefits [2].

Despite these advantages, breast-feeding is not widely practiced due to the pain and discomfort of cesarean section wounds [3], breast engorgement, and breast pain [4]. Mothers who undergo cesarean births may neglect breast care due to the pain after the surgery, which requires medical attention. Taking into consideration the birth history, which affects the breast-feeding period [5], primiparous women may need an active breast care intervention. It is recommended to initiate breast-feeding within 30 minutes after delivery and prior to the development of breast engorgement. Early breast care is known to promote lactation and reduce breast pain. Early breast care includes starting breast-feeding from the delivery day and breast massage using a hot towel [6].

Additional interventions to relieve breast engorgement include cold and hot packs, cabbage compress [7], massage, and acupuncture therapy [8]. Cabbage compress is a folk remedy for breast engorgement, and its mechanism is not clearly understood. Nevertheless, cabbage leaves have been reported to relieve edema caused by sprain or fracture, as well as breast engorgement [9]. In previous studies [7, 8, 10, 11], the effects of cabbage compress have

been confirmed. In developed countries, such as the USA [9], Canada [12], and Australia [13], cabbage compress is used to relieve breast engorgement as a convenient and economic nursing intervention without side effects [14].

Previous studies have confirmed that cabbage compress and breast massage reduce levels of breast engorgement, breast pain [7, 14], and breast temperature [15] and increase breast milk pH [16]. In those studies, breast pain was measured as an index of breast engorgement; however, breast engorgement itself was not measured. In the present study, breast hardness was measured using a durometer to assess breast engorgement [17].

After a cesarean delivery, primiparous women without breast-feeding experience were provided with early breast care (EBC) and cabbage compress from the second postpartum day to promote effective breast-feeding initiation before breast engorgement. The levels of breast pain and breast hardness and body temperature were compared in order to determine the effects of the treatment and suggest a breast care intervention method. The aim of this study was to investigate the effects of EBC and cabbage compression EBC (CCEBC) on reducing breast pain and breast hardness in women after cesarean delivery.

Participants and methods

Participants

Prior to the study, IRB approval was obtained (EU12-079). Primiparous women who wanted to breast-feed and underwent cesarean birth between 35 and 42 weeks of gestation in E University Hospital from June 1, 2012 to February 28, 2013 were selected for this study. The women were able to communicate and provided written informed consent prior to participation in the study. Patients who had a previous pregnancy, delivery or puerperal complications, or cabbage allergy were excluded from this study. Because of the possibility of diffusion and contamination, the control and experimental groups were assigned at different times. The general nursing breast care (GNBC) group's data were collected first, followed by the data from early breast care (EBC) group, and CCEBC.

Sample size calculation

The sample size was calculated using G Power analysis. Based on the results of a previous study [18], the effect size was set at 0.4, the significance level was set at 0.05, and the test power was set at 0.8 in order to calculate the sample size. Taking into account an estimated dropout rate of 10%, 22 participants were needed for each group.

Intervention

In this study, EBC received early breast care, while CCEBC received early breast care and cabbage compress. In contrast to conventional breast care, early breast care is conducted before lactation and development of breast engorgement. The process is required three times a day for a period longer than 10 minutes prior to breast-feeding from the 2nd to the 4th postpartum day [19]. Mothers are recommended to massage their breasts using their hands. The group I mothers breast-fed after the early breast care.

Cabbage compress was used based on the literature [9]. In order to confirm cabbage sensitivity of the skin, a cabbage leaf is attached and fixed on the antebrachium using a wrap, and the skin is checked for any flare development [9]. In the present study, the breast skin conditions of cabbage compress plus EBC were examined prior to the treatment, and any skin flare development was checked. No subjects showed cabbage sensitivity.

Cabbage leaves were washed and refrigerated for more than 3 hours at 2~5°C before use. The leaves were then applied to the whole breast area, other than the nipple, three times a day for 20 minutes from the 2nd to the 4th postpartum day [9].

Outcome measures

Breast pain: The subjects used the Visual Analogue Scale (VAS) to indicate breast pain levels; the scale ranged from a score of 0 (no breast pain) to 10 (severe breast pain). The subjects marked their pain levels on a 10-cm long line in millimeters.

Breast hardness: Breast hardness was measured using a rubber durometer (Shore C,

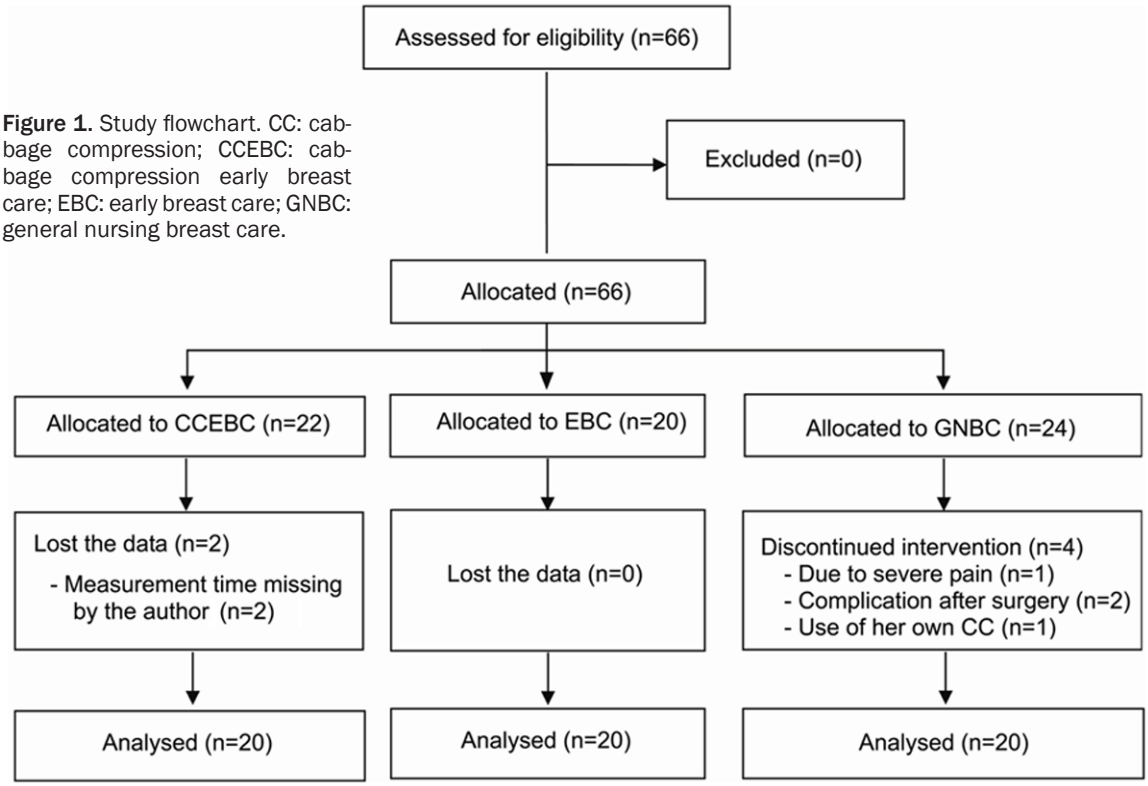

Figure 1. Study flowchart. CC: cabbage compression; CCEBC: cabbage compression early breast care; EBC: early breast care; GNBC: general nursing breast care.

HANDPI, China). When an object to be measured makes contact with the pressure supporter plate, the spring inside the durometer pushes the object, thereby producing a repulsive force. Hardness is determined as the equilibrium of these two forces. When the repulsive force is weaker than the pushing force, hardness is low, and vice versa. When the breast was not hard, a score of 0 was given, and when the breast was extremely hard, a score of 100 was given to one decimal place. In the present study, the durometer was used at the area that was 3 cm from both nipples in the 10 o'clock and 2 o'clock positions to obtain mean measurements. Higher measurements represented harder breasts.

Body temperature: Core and breast skin temperatures were used as body temperature measurements. The core temperature was measured from both ears using a tympanic thermometer (Infrared Thermometer IRT 4020, Braun, Germany), and the mean value was used for analysis. Meanwhile, the breast skin temperature was measured using a non-contact body thermometer (Termofocus 01500 HuBDIC, Italy) in the area 3 cm from both nipples in the 10 o'clock and 2 o'clock positions to obtain mean values.

Breast milk pH: BTB is a test paper used to measure pH in the range of 6.2-7.8 at 0.2 intervals. Breast milk was obtained by squeezing the breast by hand and absorbing the breast milk onto the pH test paper; the paper's color was then matched to the standard colors in order to determine the pH. The colostral pH was 7.4, but the pH gradually decreased to the lowest level at 1-2 weeks postpartum. The level gradually increased soon after. The pH showed ranged from 6.8 to 7.3 and the mean pH was 7.0 [20].

Data collection

To secure the same experimental environment, the subjects were selected from the primiparous women who underwent cesarean birth in the Obstetrics Department of E University Hospital. The patients were appropriate candidates for the purpose of this study and agreed to participate in the study. To prevent experimental diffusion and contamination, the control group was investigated first, followed by

Table 1. Hemogeneity of general characteristics and pregnancy-related characteristics among three groups

Category	Early breast care plus cabbage compress (n=20)	Early breast care (n=20)	General nursing breast care (n=20)	F or χ^2	*P*
	Mean ± SD	Mean ± SD	Mean ± SD		
Age (yr)	32.7±2.78	31.6±4.10	31.5±3.71	0.73	.49
Gestation period (days)	261.4±12.67	258.2±10.44	262.1±8.35	0.75	.48
Pre-pregnancy body weight (kg)	55.3±10.53	57.7±10.05	56.6±10.49	0.26	.77
Body weight at term (kg)	69.3±9.82	73.7±13.03	69.5±9.32	1.03	.37
	N (%)	N (%)	N (%)		
Education					
High school	5 (25.0)	7 (35.0)	4 (20.0)	9.45	.31
College	10 (50.0)	9 (45.0)	16 (80.0)		
College above	5 (25.0)	4 (20.0)	0 (0.0)		
Job					
Yes	10 (50.0)	8 (40.0)	8 (40.0)	0.54	.76
No	10 (50.0)	12 (60.0)	12 (60.0)		
Religion					
Yes	14 (70.0)	12 (60.0)	9 (45.0)	2.61	.27
No	6 (30.0)	8 (40.0)	11 (55.0)		
Fetus					
Single	14 (70.0)	15 (75.0)	18 (90.0)	2.55	.28
Twin	6 (30.0)	5 (25.0)	2 (10.0)		
Type of nipple					
Normal	16 (80.0)	16 (80.0)	19 (95.0)	2.35	.31
Flat/Inverted	4 (20.0)	4 (20.0)	1 (5.0)		
Breast-feeding plan					
<6 months	10 (50.0)	5 (25.0)	7 (35.0)	5.15	.27
6-12 months	7 (35.0)	12 (60.0)	7 (35.0)		
>12 months	3 (15.0)	3 (15.0)	6 (30.0)		

EBC and CCEBC with a time difference. The subjects' general and pregnancy-related characteristics were investigated in advance.

EBC received more than 10 minutes of early breast care prior to breast-feeding between the 2nd and 4th postpartum day. Cabbage compress plus EBC received early breast care and cabbage compress three times a day for 20 minutes between the 2nd and 4th postpartum day. A ward nurse, who was unaware of the study, provided the control group, EBC, and cabbage compress plus EBC with the hospital's standard breast-feeding education on the first postpartum day. The control group's use of professional massage and the use of hot packs or cabbage compress were not restricted due to ethical reasons; however, any subjects who received these treatments were excluded from the study. To determine the effects of the treatments, the levels of breast pain, breast hardness, and the core and breast skin body temperatures of the control group and experimental groups I and II were measured from the 2nd to the 4th postpartum day at pre-feeding (7 PM). At this time, the early breast care and cabbage compress had been provided. At post-feeding (9 PM), the levels of breast pain, breast hardness, and core and breast skin temperatures were measured again. At post-feeding (9 PM) on the 4th postpartum day, the breast milk pH was also measured.

Data analysis

The subjects' general and pregnancy-related characteristics were analyzed using real numbers, percentage, χ^2-test and ANOVA. The data analysis was performed using SPSS (ver 20.0). For effect test verification, the levels of breast

Table 2. Comparison of breast pain and hardness after experimental treatment

Outcomes	Time	Early breast care plus cabbage compress (n=20)	Early breast care (n=20)	General nursing breast care (n=20)	F (*p*) (LSD)
Breast pain					
	2nd postpartum day				
	Pre feeding (7 pm)	0.85±2.03	1.65±2.87	1.35±2.08	0.586 (.560)
	Post feeding (9 pm)	0.45±1.00	1.35±2.74	1.65±2.21	1.750 (.183)
	3rd postpartum day				
	Pre feeding (7 pm)	1.75±2.29	1.90±2.47	3.30±2.43	2.542 (.088)
	Post feeding (9 pm)	1.50±1.93	1.50±2.67	3.00±2.27	2.813 (.068)
	4th postpartum day				
	Pre feeding (7 pm)	1.80±2.09	1.40±1.88	3.10±2.95	2.852 (.066)
	Post feeding (9 pm)	1.00±1.65	1.05±1.88	2.60±2.70	3.660 (.032) a, b<c
Time: 3.091 (P=.016); G*T: 0.599 (P=.812); Group: 3.903 (P=.026)*					
Breast hardness					
	2nd postpartum day				
	Pre feeding (7 pm)	4.29±3.19	7.20±2.64	7.68±2.94	7.824 (.001) a<b, c
	Post feeding (9 pm)	3.56±3.20	6.88±3.09	7.71±3.31	9.409 (<.001) a<b, c
	3rd postpartum day				
	Pre feeding (7 pm)	5.73±3.37	8.28±4.96	9.53±3.77	4.492 (.015) a<b, c
	Post feeding (9 pm)	4.20±3.55	6.46±2.94	9.08±3.40	10.935 (<.001) a<b, c
	4th postpartum day				
	Pre feeding (7 pm)	5.28±2.97	7.63±3.44	7.81±2.86	4.125 (.021) a<b, c
	Post feeding (9 pm)	3.88±3.08	6.43±3.40	8.86±2.90	12.649 (<.001) a<b, c
Time: 4.932 (P=.001); G*T: 1.841 (P=.062); Group: 12.460 (P<.001)*					

Values are expressed as mean ± standard deviation. *Repeated measures of ANOVA; LSD post hoc analysis.

pain, breast hardness, core and breast skin temperatures, and breast milk pH of the three groups were compared using ANOVA, post-hoc test, and repeated measures of ANOVA.

Results

In this study, the data collected from 60 out of the 66 patients were used. The six patients excluded from the study were one control group patient who stopped breast-feeding due to severe breast engorgement, two control group patients who developed complications after the surgery, one control group patient who tried her own cabbage compress, and two experimental group patients whose measurement time was missed by the author (**Figure 1**).

The group did not differ significantly in age, gestation period, pre-pregnancy body weight, education, type of nipple, and breast feeding plan (**Table 1**).

The pre-feeding breast pain levels on the 2nd and 3rd postpartum day were not significantly different among the three groups (**Table 2**). The pre-feeding scores on the 4th postpartum day were not significantly different. However, the post-feeding scores were significantly different among the three groups (F=3.660, *P*=.032). Both EBC plus cabbage and EBC showed significantly lower pain levels than the no-treatment group (*P*<.05). Analysis of the breast pain scores, which were measured six times, showed a significant difference over time (F=3.091, *P*=.016). There was no significant difference in the group and time interaction, but breast pain levels in each group were significantly different (F=3.903, *P*=.026).

There was a significant difference in pre-feeding breast hardness among three groups on the 2nd, 3rd, and 4th postpartum days. Post-hoc analysis showed the lowest hardness level in EBC plus cabbage compression among the three groups (*P*<.05). The breast hardness, which was measured six times, showed a significant difference over time (F=4.932, *P*=.001). There was no significant difference in the group

Table 3. Comparison of body temperature after experimental treatment

Outcomes	Time	Early breast care plus cabbage compress (n=20)	Early breast care (n=20)	General nursing breast care (n=20)	F (*p*)
Core temperature					
	2nd postpartum day				
	Pre feeding (7 pm)	37.07±.49	36.86±.42	37.02±.56	1.022 (.366)
	Post feeding (9 pm)	36.96±.50	36.86±.49	36.90±.50	0.204 (.816)
	3rd postpartum day				
	Pre feeding (7 pm)	36.79±.29	36.79±.39	36.63±.25	1.736 (.185)
	Post feeding (9 pm)	36.72±.36	36.66±.36	36.60±.27	0.726 (.488)
	4th postpartum day				
	Pre feeding (7 pm)	36.86±.26	36.73±.30	36.75±.26	1.443 (.245)
	Post feeding (9 pm)	36.78±.30	36.59±.32	36.71±.29	2.004 (.144)
Time: 3.774 (P=.005); G*T: 0.699 (P=.723); Group: 1.589 (P=.213)*					
Breast skin temperature					
	2nd postpartum day				
	Pre feeding (7 pm)	37.22±0.94	36.84±0.51	37.22±0.58	1.914 (.157)
	Post feeding (9 pm)	36.55±2.00	36.58±1.78	37.20±0.73	1.037 (.361)
	3rd postpartum day				
	Pre feeding (7 pm)	37.22±0.72	37.01±0.64	36.73±0.73	2.430 (.097)
	Post feeding (9 pm)	37.05±0.62	37.02±0.58	36.83±0.74	0.628 (.538)
	4th postpartum day				
	Pre feeding (7 pm)	37.51±0.50	36.56±1.93	36.90±0.81	2.998 (.058)
	Post feeding (9 pm)	37.17±0.59	37.05±0.63	36.95±0.71	0.568 (.570)
Time: 0.878 (P=.502); G*T: 1.554 (P=.131); Group: 1.023 (P=.366)*					

Values are expressed as mean ± standard deviation. *Repeated measures of ANOVA.

and time interaction; however, the breast hardness measurements were significantly different among three groups (F=12.460, *P*<.001) (**Table 2**).

There were no significant differences in pre-feeding core temperatures on the 2nd, 3rd, or 4th postpartum day among the three groups (**Table 3**). On the other hand, there was a significant difference over time in the post-feeding core temperatures (F=3.774, *P*=.005). There was no significant difference in the group and time interaction and the core temperature measurements were not significantly different among the three groups (**Table 3**).

There were no significant differences in the breast skin temperatures (pre-feeding and post-feeding) on the 2nd, 3rd, or 4th postpartum day among the three groups. Breast skin temperature did not show any significant differences over time. In addition, there was no significant difference in the group and time interaction. The breast skin temperatures were not significantly different among the three groups (**Table 3**).

The pH levels for CCEBC, EBC and the control group were 7.1±0.15, 7.2±0.15, and 7.3±0.33, respectively. No significant difference in breast milk pH will be observed among three groups.

Discussion

This study compared the effects of CCEBC with EBC on the breast pain, breast hardness, core temperature, breast skin temperature, and breast milk pH among primiparous women after a cesarean birth. The results show that CCEBC and EBC significantly reduced breast pain compared with no-treatment group.

Breast pain usually increases on the 3rd postpartum day due to mammary gland development and breast swelling [20] and is reduced with the release of milk. This is the reason why no significant difference among the group during the first three days after delivery compared

with the control group. The results of this study corresponded to those of a previous study that showed a decrease in postpartum breast pain after hot/cold packs and cabbage compress were applied three times a day for two days [7]. These results indicated that early breast care and cabbage compress, which were applied before the development of breast engorgement, could have reduced breast pain. The pain scores in the present study were not higher than those reported in previous studies [7, 16] because all of the subjects received analgesics via patient controlled analgesia (PCA) following the cesarean birth. This medication was considered a confounding variable, but the analgesic administration was not controlled due to ethical reasons.

There was significant difference in breast hardness prior to the 2nd day of postpartum breastfeeding after treatment. In the post-hoc analysis, the CCEBC showed the lowest breast hardness level among the three groups. During the 3rd and 4th days postpartum, there was a significant difference among the three groups, and the CCEBC showed the lowest level. This indicated that the early breast care and cabbage compress, which were conducted for CCEBC, were considered to have been effective for relieving breast hardness. Based on the results of this study, the experimental treatments have softened the breast and reduced the engorgement level. As recommended in the previous study [21], the durometer was suitable for measuring the hardness of the breast engorgement. However, there was no studies measured the change in hardness of the breast engorgement by durometer after applying cabbage leaves. However, the results of current study after applying the cabbage leaves were similar to results of lowering breast tenderness score in the experimental cabbage group compared with control routine care group [18]. In further studies to find the effect of applying cabbage leaf on breast hardness, it is necessary to measure by durometer as objective index as well as patient's appeal as subjective index.

The breast pain could have been affected by the PCA confounding variable. Therefore, CCEBC and EBC can be recommended as an effective intervention to relieve breast engorgement. Moreover, both intervention are economical and convenient, so these treatments can be used as nursing interventions on the 2nd postpartum day, even before signs of breast engorgement.

There were no significant differences in the pre-feeding or post-feeding core or breast skin temperatures among the three groups. The body temperature was expected to decrease, considering that the breast swells before breast-feeding and reduces soon after; however, this change was not confirmed in the present study. To confirm such changes, the body temperature may need to be measured after the 4th postpartum day when the breast is sufficiently emptied after breast-feeding.

There was no significant difference in the breast milk pH among the three groups. Three to four days after delivery, only a small amount of colostrum is produced, and from that time point, for approximately two weeks, mature milk replaces the colostrum [2]. The measurements in the present study were conducted during the 4th postpartum day when breast milk was insufficient. Accordingly, additional measurements may be necessary.

This study has several limitations, including small sample size, and lack of an equivalent control group for estimating the expectation effects. Moreover, no random sequence generation and allocation concealment increase the risk of bias and may exaggerate the real effects of experimental interventions. Further randomized controlled trials with possible placebo treatment should be carried out to elucidate the non-specific effects of cabbage compression and EBC.

In conclusion, CCEBC and EBC maybe recommended as nursing interventions to relieve postpartum breast pain and breast engorgement. Further rigorous studies are warranted.

Disclosure of conflict of interest

None.

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