
OBSTETRICS

Effect of Electric Breast Pump versus Conventional Breastfeeding on Onset of Lactation in Post-cesarean Women: A randomized controlled trial

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ABSTRACT

Objectives: To study the time to onset of lactation (OL) when using an electric breast pump compared with conventional breastfeeding in post-cesarean women.

Materials and Methods: Thirty-four post-cesarean women under spinal block were randomized into two groups: the electric breast pump group (i.e. conventional breastfeeding combined with electric breast pump) and the conventional breastfeeding group. The electric breast pump group started using the electric breast pump within 3 hours of operation, 15 min for each pumping session, every 3 hours after breastfeeding until time to OL. The conventional breastfeeding group breastfed on demand at least 8 times in 24 hours. Post-cesarean women recorded time to OL by maternal perception when they had any one signs and/or symptoms of breast fullness, breast tingling, milk leakage.

Results: The time to OL in the electric breast pump group was significantly earlier than in the conventional breastfeeding group (43.8 ± 11.0 hours versus 68.3 ± 19.9 hours, respectively, $p < 0.001$). Maternal nipple pain after immediate use of the electric breast pump and breastfeeding ($p = 0.74$), and length of hospital stay ($p = 0.88$) were not statistically significant between groups.

Conclusion: Post-cesarean women in the electric breast pump group had significantly earlier time to OL compared with women in the conventional breastfeeding group.

Keywords: electric breast pump, conventional breastfeeding, onset of lactation.

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ผลของการใช้เครื่องปั๊มนมไฟฟ้าเปรียบเทียบกับการให้นมบุตรปกติต่อระยะเวลาที่เริ่มหลังน้ำนมเต็มเต้าในสตรีหลังผ่าตัดคลอด: การทดลองแบบสุ่มที่มีกลุ่มควบคุม

สิริกัลยา เมืองบาล, รุ่งฤดี จิระทรัพย์, ทุมวดี ตั้งศิริวัฒนา

บทคัดย่อ

วัตถุประสงค์: ผลของการใช้เครื่องปั๊มนมไฟฟ้าเปรียบเทียบกับการให้นมบุตรปกติต่อระยะเวลาที่เริ่มหลังน้ำนมเต็มเต้าในสตรีหลังผ่าตัดคลอด: การทดลองแบบสุ่มที่มีกลุ่มควบคุม

วัตถุประสงค์และวิธีการ: สตรีตั้งครรภ์ที่ได้รับการผ่าตัดคลอดโดยการระงับความรู้สึกด้วยการฉีดยาชาเข้าช่องไขสันหลัง 34 ราย ได้รับการสุ่มเป็น 2 กลุ่ม คือ กลุ่มที่ใช้เครื่องปั๊มนมไฟฟ้า (การให้นมบุตรปกติรวมกับการใช้เครื่องปั๊มนมไฟฟ้า) และกลุ่มที่ให้นมบุตรปกติกลุ่มที่ใช้เครื่องปั๊มนมไฟฟ้าจะได้เริ่มใช้เครื่องปั๊มนมไฟฟ้าปั๊มเต้านมภายใน 3 ชั่วโมง หลังผ่าตัดคลอดปั๊มนาน 15 นาทีต่อครั้ง ทุก 3 ชั่วโมง หลังจากให้นมบุตร จนมีอาการหรืออาการแสดงของการเริ่มหลังของน้ำนมเต็มเต้ากลุ่มให้นมบุตรปกติให้นมบุตรอย่างน้อย 8 ครั้ง ใน 24 ชั่วโมง สตรีหลังผ่าตัดคลอดทั้ง 2 กลุ่ม บันทึกเวลาเมื่อมีอาการและอาการแสดงอย่างใดอย่างหนึ่งของการเริ่มหลังของน้ำนมเต็มเต้าโดยการรับรู้ของมารดาได้แก่ เต้านมคัดตึงเสียวแปลบที่บริเวณเต้านมและมีน้ำนมไหลหยด

ผลการศึกษา: กลุ่มที่ใช้เครื่องปั๊มนมไฟฟ้าพบว่ามีระยะเวลาการเริ่มหลังของน้ำนมเต็มเต้าเร็วกว่ากลุ่มที่ให้นมบุตรปกติอย่างมีนัยสำคัญทางสถิติ (43.8 ± 11.0 ชั่วโมง และ 68.3 ± 19.9 ชั่วโมง, $p < 0.001$) ระดับความเจ็บที่หัวนม ($p = 0.74$) และระยะเวลาในการนอนโรงพยาบาล ($p = 0.88$) ไม่แตกต่างกันอย่างมีนัยสำคัญทางสถิติ

สรุป: สตรีหลังผ่าตัดคลอดในกลุ่มที่ใช้เครื่องปั๊มนมไฟฟ้ามีระยะเวลาการเริ่มหลังของน้ำนมเต็มเต้าเร็วกว่ากลุ่มที่ให้นมบุตรปกติอย่างมีนัยสำคัญทางสถิติ

คำสำคัญ: เครื่องปั๊มนมไฟฟ้า, การให้นมบุตรปกติ, ระยะเวลาที่เริ่มหลังน้ำนมเต็มเต้า

Introduction

Exclusive breastfeeding can reduce, and has a protective effect on, gastrointestinal infections, respiratory diseases, sepsis, and lowers the incidence of sudden infant death syndrome⁽¹⁾. A long-term outcome of breastfeeding is higher scores on developmental and intelligence tests⁽²⁾. United Nations Children's Fund (UNICEF) and the World Health Organization (WHO) recommend initiating breastfeeding within an hour of delivery and continuing to exclusive breastfeeding until six months of life⁽³⁻⁴⁾. Mothers who exclusively breastfeed with no prelacteal feeding have earlier onset of lactation because infant suckling induces secretion of lactogenic hormones⁽⁵⁾.

Lactogenesis stage II starts copious milk production after delivery usually at day 2-3 postpartum⁽⁶⁾. The gold standard for determining lactogenesis stage II is the measurement of milk transfer, which is tested by weighing the infant before and after each breastfeeding⁽⁷⁾. Such test weighing is impractical for use in the general population because it is disruptive for the infant and has a high cost. The onset of lactation (OL) by maternal perception is an alternative method for detecting OL: the mother senses breast fullness, breast tingling, and milk leakage. This method is practicable indicator of lactogenesis stage II due to its being non-invasive, low cost and useful for public health⁽⁷⁾.

Delayed OL (> 72 h) is a public health concern because women with delayed OL can cause fetal hypoglycemia, excessive infant weight loss, lack of maternal confidence and shorter breastfeeding duration compared with women who have earlier OL^(8,9). Previous studies reported the factors affecting delayed OL included diabetes, stress, and cesarean section. Cesarean section resulted in a significantly higher rate of delayed OL compared to vaginal delivery (12.1% versus 3.4%)⁽⁹⁾. This result may be explained by the lower rate of early initiation of breastfeeding within the first 24 h, delayed skin-to-skin contact, mother fatigue, and

pain from the operative site making it difficult to hold the baby^(10,11).

Slusher et al reported that postpartum women who utilized an electric breast pump had significantly higher milk volume compared with hand expression⁽¹²⁾. Fewtrell et al also found that electric breast pump use increased milk volume in mothers whose infants were delivered before gestational age less than 34 weeks⁽¹³⁾. Zhang et al found that post-cesarean women who used electric breast pump had significantly earlier time to OL by test weighing and higher milk supply compared with conventional breastfeeding⁽¹⁴⁾. There has, however, been no study about the time to OL by maternal perception in post-cesarean women, comparing between electric breast pump and conventional breastfeeding.

The rate of cesarean section has been increasing in both developed and developing countries⁽¹⁵⁾. Lactation in women who give birth by cesarean delivery can be delayed. The current study was conducted to evaluate the effectiveness of the electric breast pump versus conventional breastfeeding regarding time to OL by maternal perception in post-cesarean women, comparing between electric breast pump and conventional breastfeeding.

Materials and Methods

This randomized controlled trial was approved by the Khon Kaen Hospital Institute Review Board in Human Research (KEF62019) before the study. We included term singleton post-cesarean women under spinal block with intrathecal spinal morphine. Subjects were able to speak, read, and write Thai. We excluded mothers with medical complications (diabetes mellitus, severe hypertension), serious intraoperative and postpartum complications (early postpartum hemorrhage, pelvic organ injury), abnormal breasts and nipples, contraindications for breastfeeding (maternal Human Immunodeficiency Virus (HIV) infection), postpartum mother-infant separation, neonatal birth weight < 2,500 g, birth

asphyxia (Apgar score at 1 min \leq 7), tongue-tied, cleft lip or cleft palate.

Women who planned to undergo cesarean delivery were informed about the study, and ten steps to successful breastfeeding in the labor room⁽¹⁶⁾. Written informed consent was obtained from each participant before enrollment. At 2 hours after the operation, post-cesarean women with infants who met the eligibility criteria were randomized into two groups: electric breast pump and conventional breastfeeding by using a computer-generated list and allocation concealment by sequentially opaque envelopes. Each group was assigned to a different postpartum ward to preclude cross-talk contamination.

The electric breast pump group received a double collection electric breast pump (Spectra®Dew 350, Uzinmedicare Co.) and were instructed in steps of its use by trained physicians and nurses who not involved in the study. The steps of operation were started by putting breast shields cover both breasts with the suction setting at 100 mmHg then gradually increasing as tolerated. The cycling rate was 48 cycles/min, duration 15 min, interval 3 hours after breastfeeding (8 times in 24 hours). The conventional breastfeeding group breastfed on demand at least 8 times in 24 hours. The electric breast pump group used the electric breast pump until the women had any signs and/or symptoms of OL. All participants were informed about the signs and symptoms of OL via maternal perceptions, including breast fullness, breast tingling, and milk leakage. A personal digital clock with a standard time setting was provided for recording the time to OL when the mother noticed any signs and/or symptoms of OL. Ward nurses reminded the mothers of the signs and symptoms of OL three times a day. Women who had delayed OL after discharge were followed-up via telephone so as to record time to OL. Maternal nipple pain was immediately evaluated by numerical pain score (0-10) after each pump in the electric breast pump group and after each breastfed in conventional breastfeeding group in the first 24 hours. Baseline

characteristics of maternal outcomes and neonatal outcomes, time to initiate breastfeeding and length of hospital stay were recorded.

The sample size was calculated based on a pilot study with a power of 90% and a dropout rate of 10%. Thirty-four participants (17 in each group) were recruited. Data were analyzed by Stata version 13. The student t-test and Mann–Whitney U test were used to compare continuous variables depending on the normality of distribution between groups. The results were presented as means and standard deviations or medians and interquartile ranges. The Fisher's exact and chi-squared tests were used to compare categorical variables as appropriate, and the results were presented as numbers and percentages. The cumulative rate of time to OL by maternal perception was analyzed using a survival analysis. A p value < 0.05 was considered statistically significant.

Results

Between February 7 and March 27, 2020, 53 eligible post-cesarean women who had undergone spinal block with intrathecal spinal morphine were enrolled in the study. Of these, 19 women were excluded from the study: 3 because of serious medical conditions (uncontrolled diabetes mellitus, severe hypertension, and venous sinus thrombosis), 3 because of contraindications for breastfeeding (2 HIV infection and 1 maternal amphetamine use), 12 because of mother-infant separation (11 due to respiratory distress and 1 due to diaphragmatic hernia), and 1 cleft lip. Thus, a total of 34 eligible women were randomly assigned to the electric breast pump group and the conventional breastfeeding group: 17 for each group. There were no dropouts (Fig. 1). Baseline characteristics were similar between groups, including gestational age, body mass index (pre-pregnancy, pre-delivery), parity, indication for cesarean section, operative time, time to initiate breastfeeding, frequency of breastfeeding, frequency of breast pump until time to OL, and neonatal characteristics (Table 1).

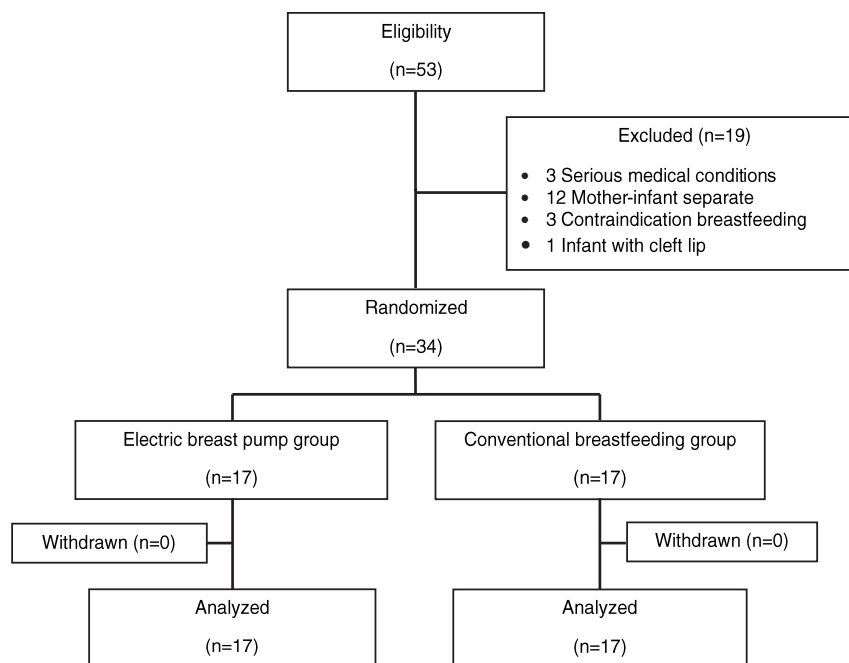


Fig. 1. Study flow.

Table 1. Baseline characteristics.

Demographic profile	Electric pump (n = 17)	Conventional (n = 17)	p value
Maternal characteristics			
GA (days), mean \pm SD	273 \pm 6.7	267 \pm 5.3	0.13
BMI (kgs/m ²), mean \pm SD			
Pre-pregnancy	25.6 \pm 5.3	25.5 \pm 7.9	0.97
Pre-delivery	31.5 \pm 5.0	29.2 \pm 5.5	0.20
Parity			0.15
Primipara, n (%)	8 (47.1)	4 (23.6)	
Multipara, n (%)	9 (52.9)	13 (76.4)	
Indication for cesarean section, n (%)			0.29
Cephalopelvic disproportion	8 (47.1)	3 (17.6)	
Previous cesarean section	7 (41.1)	12 (70.6)	
Abnormal presentation	1 (5.9)	1 (5.9)	
Other	1 (5.9)	1 (5.9)	
Operative time (min), mean \pm SD	47.4 \pm 13.4	46.8 \pm 13.7	0.90
Time to initiate breastfeed (min), mean \pm SD	156.3 \pm 41.4	184.5 \pm 96.3	0.27
Frequency of breastfeeding (times/day), mean \pm SD	16.0 \pm 2.7	15.5 \pm 2.2	0.53
Frequency of breast pumps until time to OL (times), mean \pm SD	13.8 \pm 3.2	N/A	
Neonatal characteristics			
Neonatal birth weight (g), mean \pm SD	3337.1 \pm 356.6	3197.6 \pm 378.8	0.27
APGAR score at 1 min, mean \pm SD	8.1 \pm 0.4	8.3 \pm 0.5	0.13

GA: gestational age, BMI: body mass index, SD: standard deviation, n: number of patients, OL: onset of lactation, N/A: non applicable

Time to OL by maternal perception was the primary outcome and was 43.8 ± 11.0 hours and 68.3 ± 19.9 hours in the electric breast pump group and conventional group, respectively. The mean difference was -24.5 (95% CI -35.7 to -13.8), $p < 0.001$. The time to OL in the electric breast pump group was mostly (70.6%) by day 2 while it was

mostly (52.9%) by day 3 in the conventional breastfeeding group albeit 6 women (35.3%) had delayed OL (Table 2). The cumulative rate of time to OL between groups is shown in Fig. 2. The median time to OL in the electric breast pump group was 41 hours compared to 63 hours in the breastfeeding group.

Table 2. Time to OL.

Time to OL	Electric pump (n = 17)	Conventional (n = 17)	Mean difference	95%CI	p value
OL by mean \pm SD, h	43.8 \pm 11.0	68.3 \pm 19.9	-24.5	-35.7, -13.8	< 0.001
OL by day of postpartum, h					
Day 1, n (%)	0	0			
Day 2, n (%)	12 (70.6)	2 (11.8)			
Day 3, n (%)	5 (29.4)	9 (52.9)			
> Day 3, n (%)	0	6 (35.3)			

OL: onset of lactation, CI: confidence interval, SD: standard deviation, n: number of patients

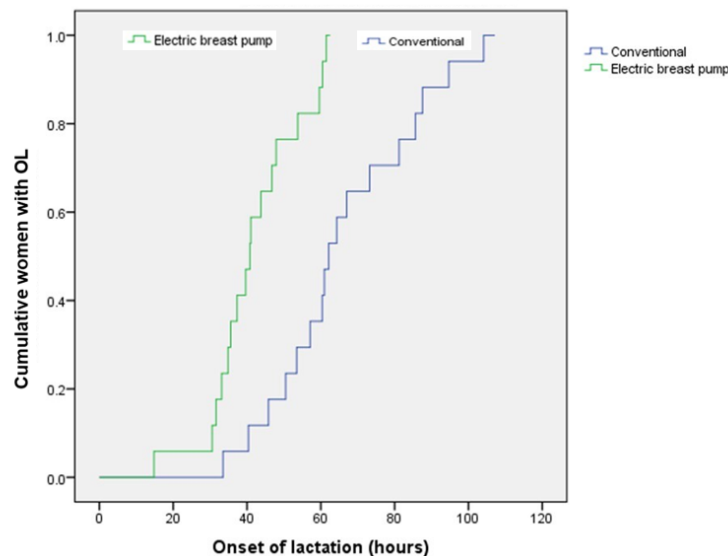


Fig. 2. Cumulative rate of time to onset of lactation.

Maternal and neonatal outcomes are presented in Table 3. Maternal nipple pain was 3.0 (0, 6) and 3.0 (0, 7) in the electric breast pump group and the conventional breastfeeding group, respectively ($p = 0.74$). There was no significant difference in maternal nipple abrasion between groups. There was no

neonatal excessive weight loss ($> 10\%$ of birth weight) in either group. Two neonates in the conventional breastfeeding group had early jaundice due to glucose-6-phosphate Dehydrogenase deficiency and ABO incompatibility. The length of hospital stay was similar between groups.

Table 3. Secondary outcomes.

Outcomes	Electric pump (n = 17)	Conventional (n = 17)	p value
Nipple pain score, median (IQR)	3 (0, 6)	3 (0, 7)	0.74
Nipple abrasion, n (%)	4 (23.5)	3 (17.6)	0.67
Length of stay (days), mean \pm SD	2.8 \pm 0.1	2.9 \pm 0.2	0.88
Neonatal jaundice, n (%)	0	2 (11.8)	0.48

IQR: interquartile range, SD: standard deviation, n: number of patients

Discussion

The present study aimed to evaluate the efficacy of an electric breast pump compared with conventional breastfeeding in promoting time to OL in post-cesarean women who had undergone spinal block. The electric breast pump group had 24.5 hours faster OL by maternal perception over against the conventional breastfeeding group (43.8 hours versus 68.3 hours, respectively). This result was similar to Zhang et al who reported that the electric breast pump group in post-cesarean women had a 17-hour faster OL according to test weighing (52.2 hours versus 70.6 hours, respectively)⁽¹⁴⁾. More than two-third of post-cesarean women in the electric breast pump group had OL by the second postpartum day, and the remainder had OL by the third postpartum day. By comparison, half of the conventional breastfeeding group had OL by the third postpartum day, and one-third of them had delayed OL. The results of the current study support the hypothesis that the electric breast pump stimulates breast milk production and shortens the time to OL in women who undergo a cesarean section. To contrast, Chapman et al indicated that the electric breast pump had no beneficial effect on OL as measured by infant weight before and after breastfeeding in post-cesarean women. Chapman, et al, however, used the electric breast pump only 3 times a day (maximum 45 min/day)⁽⁷⁾. Slusher et al suggested that mothers who used an electric breast pump fewer than four times daily with a total time less than 70 min per day had no increased in milk volume⁽¹²⁾. This might be explained by the efficacy of the electric breast pump used for 15 min every 3 hours or 8 times a day in the current study (120 min), which had a positive effect on faster OL. Thus, the frequency

and duration of electric breast pump affected time to OL.

Test weighing the infant is the gold standard for evaluating OL; however, this method is not practicable for general use. This conclusion is supported by a study by Zhang et al in which evaluated time to OL by testing weighing only during the day time but such an approach may have affected the accuracy of time to OL⁽¹⁴⁾. In addition, this method depends on breastfeeding episodes and need slightly sensitive scale equipment that may not be available in low resource settings. Maternal perception of OL is practicable and could be used instead of test weighing because mothers can and do notice their lactation, all day and night. Notably, the technique is low-cost and could be used to evaluate time to OL after discharge. Chapman et al likewise studied the validity of time to OL to indicate lactogenesis II comparing between test weighing and maternal perception in post-cesarean women and concluded that maternal perception of the OL was a valid public health indicator of lactogenesis stage II⁽⁷⁾.

Secondary outcomes indicated mild nipple pain in both groups without serious events related to the electrical breast pump. The current study reported that nipple abrasion mostly occurred within 24 hours postpartum at the tip of nipple as a result of improper latch-on⁽¹⁷⁾. An electric breast pump can cause nipple abrasion but is commonly located at the side of the nipple due to rubbing against the breast shield tunnel during breast pump⁽¹⁸⁾. The current study showed that the electric breast pump did not increase nipple pain and did not cause nipples trauma. There were no maternal complications in either group, and length of hospital stay was not significantly different between

groups. Excessive weight loss (> 10 %) was not found in our study because the infant formula was given to babies whose weight loss was 8% or more so as to prevent neonatal detrimental events (1 in the electric breast pump group and 3 in the conventional breastfeeding group).

The electric breast pump benefitted post-cesarean women at risk of delayed OL because of postoperative pain and fatigue by shortening the time to OL. The electric breast pump can also be used to stimulate breast milk production in mothers facing health issues or mother-infant separation, and/or improper latch-on or suckling problems. OL is the first time that mothers have confidence that they have enough breast milk to nurse their babies. Women with delayed OL have an increased risk of milk insufficiency and early infant formula supplementation, increasing the risk of cow milk protein allergy⁽¹⁹⁾. Women with early OL have, moreover, a longer exclusive breastfeeding duration compared with women with delayed OL⁽²⁰⁾.

The strength of the current study was that it was a randomized controlled trial. We minimized possible potential confounders by separating each group into different wards to prevent cross-talk contamination. We standardized the electric breast pump use by providing training by staff who not involved in the study. We also regularly reminded mothers about the signs and/or symptoms regarding time to OL. For further research, the study in mother-infant separation should be considered in terms of the role of the electric breast pump to promote breastfeeding in this group.

Conclusion

Post-cesarean women in the electric breast pump group had significance earlier time to OL when compared with conventional breastfeeding group.

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Potential conflicts of interest

The authors declare no conflicts of interest.

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