

Original Article

Manual expression and electric breast pumping in the first 48 h after delivery

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Abstract *Background:* Early feeding for preterm infants via the mother's own milk is crucial for lowering morbidity and mortality. Obtaining the mother's milk in the first few days is sometimes difficult; an effective way of mediating this problem has not yet been established. The aim of the present study was therefore to investigate whether breast pumping using a hospital-grade electric pump was more effective in maximizing the available milk volume and more comfortable than manual expression in the first 48 h after birth.

Methods: A sequential cross-over study was performed in a maternity ward, in a tertiary perinatal center, Japan. Eleven women whose infants were admitted to the neonatal intensive care unit were sequentially allocated to either manual or electric breast expression (Symphony) for their first expression after 6 h following birth. The women then used the other method for the next expression, and continued to alternate between methods until seven sessions had been completed for each method. The time interval between expressions was 3 h. Main outcome measures were volume of milk expressed per session and pain assessment at each expression using the Wong and Baker face-scale.

Results: Net milk yield per woman was 2 mL manually (median; range: 0–12.6 mL) and 0.6 mL (0–7.2 mL) by electric expression ($P < 0.05$). The frequency of women stating no pain was higher for electric pumping than manual expression (90% vs 36%, respectively; $P < 0.05$).

Conclusions: In the early postpartum period, the best way to obtain colostrum is by gentle manual expression. For mothers who feel pain during manual expression, use of the stimulation phase of the Symphony pump may be preferable.

Key words expression, human milk, intensive care unit, pumping, separation.

There exists strong and consistent evidence that feeding the mother's own milk to preterm infants of any gestation is associated with a lower incidence of infections and necrotizing enterocolitis, and an improved neurodevelopment outcome, compared with formula feeding.¹ A systematic review and meta-analysis of 10 randomized controlled trials indicated that feeding in infants of <32 weeks gestation is associated with a shorter time period to reach full enteral feeding and a shorter duration of hospitalization.¹ Minimal enteral nutrition, combined with aggressive parenteral nutrition, is regarded as a first step towards avoiding extrauterine growth retardation for very low-birthweight infants.^{2,3}

At Kanagawa Children's Medical Center, trophic feeding with the mother's own milk is started as early as 24 h after birth. Various efforts have been made to encourage mothers to start breast-feeding earlier, including encouraging neonatologists to give nutritional information to the mother at prenatal visits, and

maternity caregivers providing breast-feeding information. It has been suggested that frequent expression, starting in the first 6 h after giving birth, is crucial for successful lactation in a setting of mother–infant separation.^{4,5} Mothers whose infants have been admitted to the neonatal intensive care unit (NICU) produce only a few drops of milk in the early postpartum period. Therefore, caregivers (midwives or nurses), or the mothers themselves, express milk by hand and collect colostrum using syringes. It is common for midwives/nurses in Japan to perform manual expression of breast milk during the early postpartum period for all mothers, who expect and accept this as part of routine postpartum care. Some mothers, however, feel pain during caregivers' manual expression. Pain is reported to decrease milk production.^{6–8}

Since 2002 we have introduced a newly developed hospital-grade electric pump, which involves two-phase expression: a stimulation phase, involving a fast pumping rhythm that promotes milk flow; and an expression phase, involving slower pumping that promotes expression. The pump is reported to be as effective as, and more comfortable than, the previous hospital-grade electric pump.⁹ We have clinically confirmed these advantages of the pump after 3 or 4 days following birth.

It is hypothesized that expression using the electric pump is more effective and more comfortable than manual expression in

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the early postpartum period. The present study was conducted with the aim of testing this hypothesis.

Methods

The study was conducted in a tertiary perinatal center in Yokohama, Japan, between September 2003 and February 2004. The main referral reasons were threatened premature delivery or fetal abnormality. Maternal metabolic or hormonal disorders were not primary reasons for referral. All women whose infants were admitted to the NICU at Kanagawa Children's Medical Center were approached soon after giving birth with regard to participation in the study. The cumulative number of deliveries and live births were 190 and 187, respectively, in this period. Seventy-seven infants were admitted to the NICU. Sixty-two women were not approached due to either a shortage of time to obtain consent or a shortage of available research midwives. The remaining 15 women (19.5%) were approached, and 11 (14.3%) participated. Four of the 15 women were excluded for the following reasons: one infant recovered and returned to the mother's side within the first 48 h; one infant died; one infant became too ill to feed; and one mother wanted to be withdrawn from the study.

We compared prospectively the efficacy of the two methods for each woman. Once consent had been obtained, the first enrolled woman underwent manual expression in the 6 h after delivery. Three hours later, she used electric breast pumping. The third time, she received manual expression, and the fourth time, electric breast pumping, and so on. The time interval between expressions was 3 h. The final session ended with electric pumping. The second enrolled woman started with electric pumping and ended with manual expression.

Both methods of expression were carried out by one of the research midwives (certified midwives engaged in this study). In each session, one of the midwives collected breast milk using a 2.5 mL syringe (Terumo, Tokyo, Japan). The minimum countable volume was 0.1 mL.

Manual expression

Manual expression was performed according to the expression part of the Marmet technique.¹⁰ The Marmet technique also involves massage for encouraging milk ejection; this was not performed in the present study. The position of the woman was not changed for the purpose of the study. Most women received manual expression in a supine or semi-reclining position and the duration of expression was 5–10 min for each breast. Manual expression was performed by one of the six research midwives. To standardize the method, they were re-educated in the use of the Marmet technique, although prior to the study they had routinely performed manual expression on admitted women in their own way.

Electric pumping

One of the six research midwives pumped both breasts using the double-collection kit with the Symphony pump (Medela, Tokyo, Japan).

For the first 2 min, the midwife pumped using the nipple-stimulation mode, followed by 8 min of the expression mode.

She started with low pressure and increased the pressure to a comfortable level for the mother. Because only a few drops of milk were obtained, the midwife ensured that any drops of milk attached to the collection system were collected using a syringe. This prevented drops of milk flowing away from the breast. Mothers did not change their position and were supine or in a semi-reclining position during the expression.

Pain assessment

To assess the degree of pain in each session, all enrolled mothers were encouraged to express their degree of pain using the Wong and Baker face-scale with minor modifications. This face-scale was originally made up of six grades, which illustrate the level of pain.¹¹ We used five grades, omitting grade 1 because it was difficult to discriminate between the original grades 1 and 2. Grade 0 denoted no pain and grade 4 denoted intolerable pain.¹²

Statistics

All statistical analyses were performed using STAT VIEW version 5.0 Japanese edition for Mac on a personal computer (Hulinks, Tokyo, Japan). Student's *t*-test was used to assess normally distributed variables, and the Mann–Whitney *U*-test was used for data that were not normally distributed. Contingency table analysis with Fisher's exact probability test was used to assess the statistical difference in categorical variables. $P < 0.05$ was considered significant. Numerical variables were expressed as median values (minimum–maximum).

Ethical considerations

Enrolled women were informed of the aims, methods, and possible advantages (they could potentially receive earlier expression and expression every 3 h, which was ideal for milk production) and disadvantages (they might feel fatigue due to expression every 3 h) using written material before enrolment. They were also guaranteed routine breast-feeding care if they chose not to participate. Routine care included manual breast massage and manual expression at irregular intervals, and collection of milk if it was obtained.

Results

Eleven women completed the study. Their median age was 29 years (range, 20–40 years). The median gestation at delivery was 36 weeks (range, 29–39 weeks). Nine underwent cesarean section. Four out of five multiparous mothers had breast-fed their previous children.

Paired results from each woman using manual and electric expression

Figure 1 shows the volume of milk obtained from individual women in chronological order using manual expression and electric pumping, respectively. Figure 2 demonstrates the cumulative milk volume obtained using manual and electric expression in each woman. The median volume per woman was 2 mL (range, 0–12.6 mL) and 0.6 mL (range, 0–7.2 mL), respectively ($P < 0.05$). One woman (A) did not produce any milk by either method.

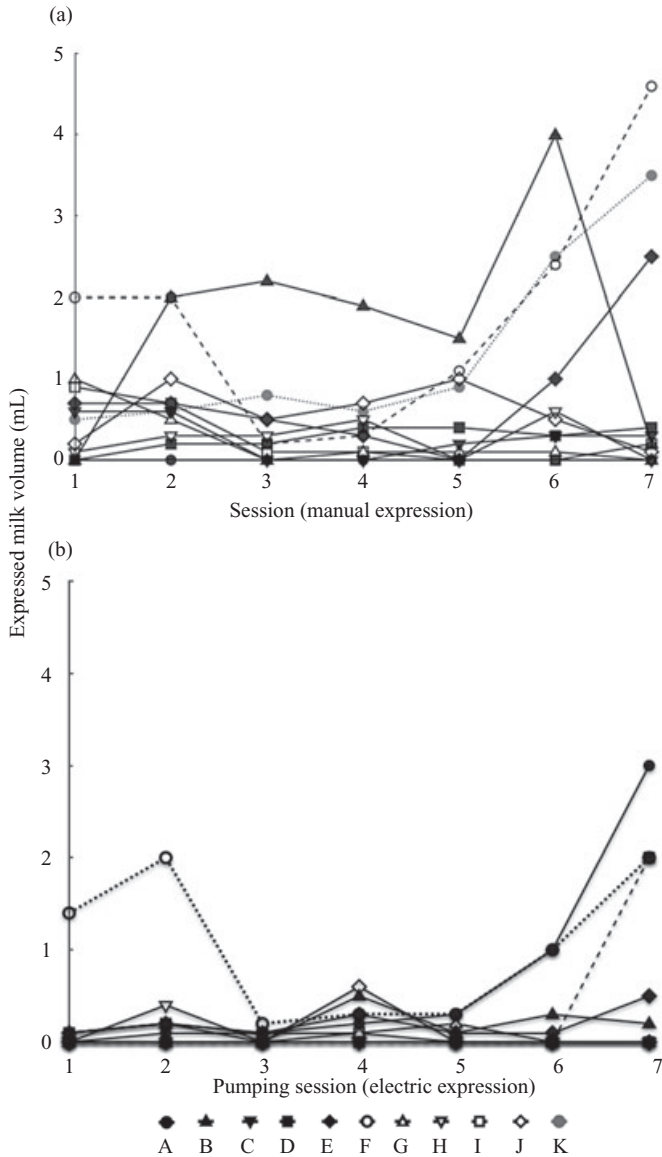


Fig. 1 Volume of milk obtained from individual women using (a) manual expression and (b) electric pumping.

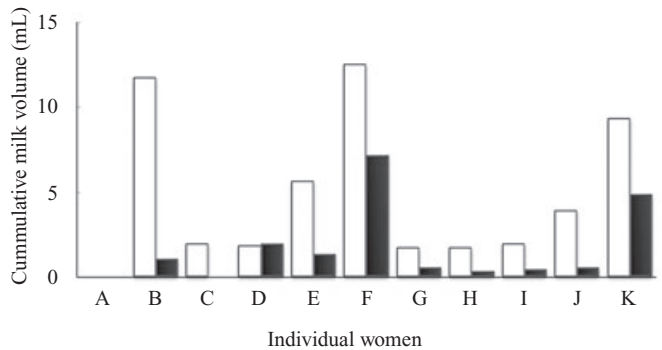


Fig. 2 Cumulative milk volume obtained by (□) manual (median, 2 mL; range, 0–12.6 mL) and (■) electric expression (median, 0.6 mL; range, 0–7.2 mL) from each woman ($P < 0.05$).

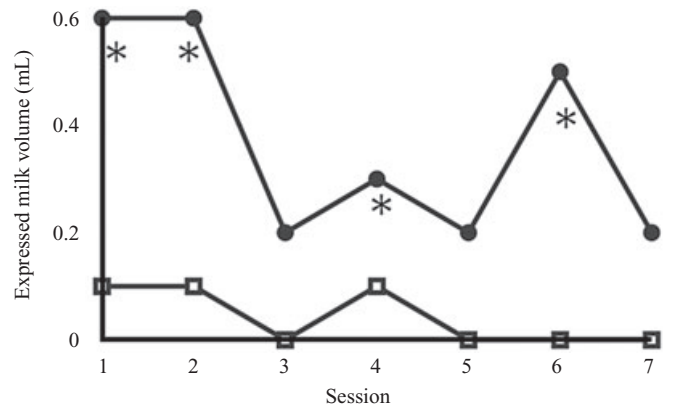


Fig. 3 Median expressed milk volume obtained from 11 women at each session. electric pumping. Transient decline was noted for both methods following initial substantial volume. (●) Manual expression yielded twice as much milk as did (□) electric pumping. Volume obtained by manual expression was greater than that obtained by electric pumping in sessions 1, 2, 4, and 6 ($*P < 0.05$).

Changing pattern of expressed milk volume

Figure 3 shows the median expressed milk volume obtained from 11 women at each session. A transient decline was noted following the initial substantial volume for both methods. Manual expression yielded twice as much milk as did electric pumping. The volume obtained using manual expression tended to be greater than that obtained using electric pumping in all sessions; the difference was statistically significant in sessions 1, 2, 4, and 6 ($P < 0.05$).

Pain during expression

Figure 4 demonstrates the median pain scale in individual women using both manual and electric expression according to the modified Wong and Baker face-scale. Two mothers expressed grade 2 pain, which denotes mild pain, in the setting of manual expression. One of these mothers also experienced pain with the electric

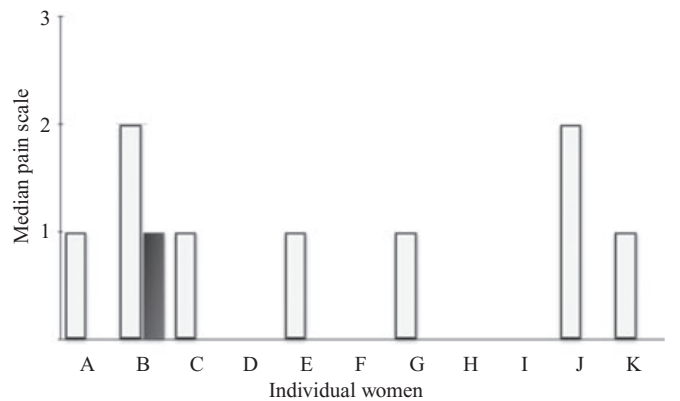


Fig. 4 Median pain scale in individual women for both (□) manual and (■) electric expression according to the Wong and Baker face-scale. The frequency of women stating grade 0 as the level of pain was higher for electric pumping than for manual expression (90% vs 36%, respectively, $P < 0.05$).

pumping. The frequency of women stating grade 0 as their level of pain was higher for electric pumping than for manual expression (90% vs 36%, respectively; $P < 0.05$). No mother reported pain greater than grade 2 (mild pain).

Discussion

The number of samples was small in the present study. We tried manual and electric expression in the same individual to avoid influences from confounding factors, including maternal medication, previous breast-feeding experience, and pregnancy complications.

It is reasonable to set the starting point at 6 h following birth, because starting expression as early as possible after birth is ideal in the setting of mother–infant separation.^{4,5} Setting the end-point at 48 h after birth is too early if trying to examine the start of lactogenesis II, which usually begins on day 2 or 3.¹³ The aim of the present study, however, was to determine the available milk volume in the first 2 days for very early enteral feeding.

Both methods were performed with the mother in a supine or semi-reclining position, which is not suitable for collecting milk. We did not, however, seek to change the mothers' position for the study because most had given birth by cesarean section.

The present results indicate that manual expression was superior to electric pumping in obtaining a higher volume of milk in the first 48 h after birth: manual expression yielded twice as much milk as electric pumping. There seem to be few studies comparing the efficacy of pumping and of manual expression during the first 48 h after delivery. Slusher *et al.* conducted a randomized controlled trial in two NICU in Africa using one of three methods of expressing the mother's own milk: double electric breast pump, double non-electric pedal breast pump, and hand (manual) expression.¹⁴ It was noted that 64 out of 65 allocated women entered the study within 2 days after giving birth, and the mean duration of one mother's pumping days was 6–10.7 days on average. There were significant differences in the mean milk volumes between the electric pump group and the hand expression group. This difference seemed to be observed from the second day of the study (173 mL vs 97 mL), but the mean milk volume on the first day was not significantly different between the electric pump group and the hand expression group (58 mL vs 67 mL). According to a recent Cochrane Database systematic review entitled 'Methods of milk expression for lactating women', there is no published research that covers milk expression in the period before 48 h after delivery.¹⁵

A study by Morton *et al.* demonstrated greater milk volume in mothers who used hand expression combined with pumping to obtain colostrum compared with electric pumping only (Morton *et al.*, unpublished data, 2009). Additional studies are required to assess the most effective method of expression in the first few days after birth.

The present results showed that electric pumping was more comfortable for mothers than was manual expression. We found that most mothers who used the electric pump were free from pain during the pumping sessions in the first 48 h, reporting that they felt a painless ejection reflex during the 'stimulation phase'.

Although we did not inform the participants of the study results, after the study period all of the enrolled mothers chose to continue to use the same type of electric pump as used in the present study.

We omitted the massage part of the Marmet technique in the present study.⁹ The results of a previous randomized controlled trial comparing the methods of expression after preterm delivery, starting 4 days after birth, showed that breast massage may have an additive effect for improving milk production, in addition to frequent pumping.¹⁶ Adding breast massage to either manual or electric expression might lead to improved milk yield.

According to the present protocol, an infant with a birthweight of <1000 g receives 1 mL per feed of his mother's milk or water on days 1 and 2, respectively. Accordingly, the infant receives 8 mL of colostrum or water 24–48 h after birth. The estimated cumulative milk volume expressed manually in the present study was 4.8 mL (mean) or 4 mL (median) during the first 48 h, which covers approximately half of the infant's needs. It has already been shown that 'to dilute colostrum in the first days does not affect the feeding outcome (days to return to birthweight and days to become full-feeding)',¹⁷

In conclusion, the mother's own milk, sometimes diluted by half, is adequate for very early enteral feeding, if mothers start manual expression every 3 h from 6 h after delivery.

Conclusion

In the early postpartum period, the best way to obtain colostrum is through gentle manual expression. For mothers who feel pain during caregivers' manual expression, use of the stimulation phase of the hospital-grade electric pump may be preferable.

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