A randomised trial of two techniques for bottle feeding preterm infants

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Aim: Preterm infants begin the transition from gastric tube feeds to sucking feeds around 34 weeks' postmenstrual age. We compared physiological stability in two bottle feeding positions, cradle hold versus side lying in preterm infants.

Methods: Randomised crossover trial of infants <34 weeks' gestation at birth, ≥34 weeks' postmenstrual age at study and receiving at least two sucking feeds/day. Two feeds were studied on successive days. A pulse oximeter measured oxygen saturation (SpO2) and heart rate (HR) before, during and 30 min after feeds. Continuous data were compared using paired t-tests and proportions using chi squared.

Results: Twenty-five study infants were mean (standard deviation (SD)) 37 (2.4) weeks' post-menstrual age and 2740 (589) g at study. There was little difference in mean (SD) SpO2 during feeds between the cradle-hold and side-lying position 94 (6) % versus 95 (6) %, respectively (P = 0.55, confidence interval (CI) –1.4, 5.4). During feeds, 17/25 (68%) experienced a period of SpO2 <80% in the cradle-hold position compared with 14/25 (56) % in the side-lying position (P = 0.26, CI 0.68, 4.10). There were no significant differences in the mean HR or number of episodes of bradycardia HR <100 bpm. There was a trend towards infants consuming a smaller mean (SD) proportion of their feed in the cradle-hold position compared with the side-lying position, 82 (25) % versus 87 (20) % (P = 0.08, CI –0.64, 10.00).

Conclusions: There was little difference in infants' physiological stability between the two bottle feeding positions. Both methods may be appropriate for the transition from gastric tube to sucking feeds in preterm infants.

Key words: bottle feeding; heart rate; infant; neonatal intensive and special care unit; oximetry; oxygen saturation.

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What is already known on this topic
1 Infants start to show readiness for suck feeding at around 34 weeks' gestation.
2 Preterm infants can have difficulty coordinating suck, swallow and breathing during sucking feeds.
3 The best technique for bottle feeding preterm infants has not been determined.

What this paper adds
1 The side-lying position is an alternative position that can be used when bottle feeding preterm infants.

Published on this topic?

CREDIBILITY

Who are the authors & where are they from?

Was study funded?

Background

Infants born prematurely often require gastric tube feeding. The transition from gastric tube feeds to sucking feeds (breast and/or bottle) usually starts around 32–34 weeks' post-menstrual age when infants begin to demonstrate the ability to coordinate sucking, swallowing and breathing. However, during sucking feeds, immature infants may experience physiological instability, including lower oxygen saturations (SpO2) and heart rates (HRs), and periods of apnoea or cyanosis. While human milk provides significant benefits particularly for the sick and preterm infant, it has been suggested that preterm infants may have enhanced physiological stability when feeding directly from the breast compared with feeding from the bottle. However, preterm infants may have sucking feeds by bottle for a number of reasons, for example infants whose mothers are no longer expressing or who are unable to be present for a breastfeed.

During bottle feeds, infants typically feed cradled in a flexed, semi-reclining ‘en face’ position. In contrast, during breastfeeding, infants are generally placed so that they lie across the mother’s abdomen in an unflexed position with the infant’s head in a straight line with their body.

In a pilot study, comparing a side-lying position against a semi-upright position for bottle feeding preterm infants, Clark et al. reported an improvement in SpO2 measurements in the side-lying position. Our primary aim was to measure the effect of the feeding position, cradle hold versus side lying, on physiological stability on pulse oximeter (PO) measurements, SpO2 and HR, during and immediately after bottle feeds. Our secondary aim was to measure the efficiency of infants completing a feed in the two bottle feeding positions.

Methods

In this randomised crossover study, infants were recruited from the Newborn Intensive and Special Care unit at The Royal Women’s Hospital, Melbourne, Australia. We enrolled infants who were making the transition from gastric tube feeds to sucking feeds. Infants were eligible to participate in the study if they were born <34 weeks’ gestation, were ≥34 weeks’ post-menstrual age at the time of the study and were receiving at least two sucking feeds (either breastfeeds or bottle feeds) daily. Exclusion criteria included craniofacial abnormalities, parental preference not to bottle feed and the use of non-standard bottles or teats.

Each infant received two study feeds. One feed was given in the cradle-hold position and the other in the side-lying position. The order of the first feed was randomised with the second feed given within the next 24 h in the alternate position. If the feed was not completed after 40 min, the remaining volume was given via the gastric tube. The timing of study feeds was such that it would not interfere with breastfeeds.

Feeding procedure

Parents were invited to feed their infant the two study feeds. Nurses and a parent involved in the study were trained in both feeding positions by one of the researchers (LM). For the cradle-hold feed, infants were positioned in a semi-reclining position with the infant’s head supported in the crook of the nurse’s arm (Fig. 1a). In the side-lying position (Fig. 1b), infants were positioned, tucked under the nurse’s arm with a pillow placed under the nurse’s arm to support the infant.

Oxygen saturation and HR

A Masimo PO (Radical V4, Masimo, Irvine, CA, USA) and sensor (low noise optical probe) were used to measure SpO2 and HR before, during and for 30 min after completion of the feed. The PO was set to acquire data with maximum sensitivity and averaged over 2-s intervals. The oximeter data (SpO2, HR and signal quality) were downloaded to a computer using the neO2M program (Girvan Malcolm, Royal Prince Alfred Hospital, Sydney, Australia) for analysis.
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Respiratory rate (RR) 

Dependent variable (DV)

The RR was recorded before the feed, every 5 min during the feed and every 10 min after the feed was completed.

Feeding efficiency 

Dependent variable (DV)

We measured the duration of the active sucking time of the feed over the 40-min preset limit and calculated the volume of feed consumed as a proportion of the total feed.

Infant’s alertness and activity 

Dependent variable (DV)

The Brazelton scale was used to measure infant’s alertness (scale 1–6, with 1 = deep sleep and 6 = crying and activity) (scale 1–5, with 1 = crying and 6 = asleep) at the beginning of the feed, 15 min after the feed started and 30 min after completion of each feed.

Statistical analysis 

3 types of statistics used

Demographic and clinical data including gestational age, birth weight, post-menstrual age, weight at time of study, oxygen concentration and type of respiratory support were extracted from the infant’s clinical record. The mean SpO2 and HR before, during and after feeds were determined from the PO downloads. SpO2 and HR results are presented as means and standard deviations (SDs). Paired t-tests were used to compare continuous data and proportions were compared using the chi-squared test. We used logistic regression with adjustment for repeated measures to explore whether type of hold during feeding affected the probability of an infant experiencing a SpO2 < 80%.

Statistical analysis

Sample size

Clark et al. reported a mean (SD) 3 (4.4)% difference in SpO2 between the two feeding positions in the first 3 min after the feed commenced. To find a similar difference with 80% power and a type I error < 0.05, a sample size of 25 infants was required.

Written parental consent was obtained and the study was approved by The Royal Women’s Hospital research and ethics committees. The trial was registered with the Australian and New Zealand Clinical Trials Register (ANZCRTN12611000944932).

Results

Thirty families were approached between August 2011 and February 2012 to participate in the study. Two families declined, two enrolled infants were transferred to a nursery closer to their home before study feeds could be given and one infant was transferred before the second study feed could be given. The cohort of 25 infants had a mean (SD) gestational age of 29 (3) weeks and weighed 1158 (479) g at birth. At the time of the first study feed, they were 34 (4) weeks’ postmenstrual age and 2740 (589) g. At the beginning of feeds, there was no difference in the median (interquartile range) measure of infant alertness in the cradle-hold versus the side-lying position, 5 (5–6) versus 5 (5–6), respectively (P = 0.70).

Eight infants were receiving respiratory support (low flow oxygen n = 4; nasal continuous positive airway pressure or high flow oxygen > 4 L/min n = 4). One father gave his infant both feeds. Seven nurses fed between one and seven infants with each infant receiving both study feeds from the same nurse.

One feed in the cradle-hold position was stopped after the infant demonstrated apnoea, bradycardia (HR < 100 bpm) with SpO2 < 80% and cyanosis soon after the teat was inserted into the mouth; the infant recovered quickly. A second attempt was made to give the feed, resulting in bradycardia (HR < 100 bpm) with SpO2 < 80%. The bottle feed was discontinued, with the remainder of the feed given by gastric tube. This infant was born at 24 weeks’ gestation, birth weight 723 g. At the time of the study, the infant was 40 weeks postmenstrual age, 3510 g and not receiving respiratory support. All other study infants (n = 24) completed their feeds or discontinued after 40 min.

Oxygen saturation

DV

There was little difference in mean (SD) SpO2 between the cradle-hold and side-lying position before, during or after the feeds (Fig. 2). During feeds in the cradle-hold position, 17/25 (68%) infants experienced a period of SpO2 < 80% compared with 14/25 (56)% in the side-lying position (P = 0.26, 95% confidence interval (CI) 0.68, 4.1).

HR

DV

There was little difference in mean (SD) HR between the cradle-hold and side-lying position before, during or after the feeds (Fig. 3). Fewer infants experienced a HR < 100 bpm in the cradle-hold 5/25 (20%) versus the side-lying position 10/25 (40%) (P = 0.12, 95% CI 1.7, 2.9).

RR

DV

There were no significant differences in mean (SD) RR between the cradle-hold and side-lying position before, during or after the feeds.

Alertness was not a DV, but a potentially confounding variable

Response rate?

Statistic

Statistic

Statistic

Statistic
In our study, we tested two feeding positions, cradle hold and side lying, in preterm infants that were similar in gestational age, birth weight and postmenstrual age at the time of the feeding studies to those used in Clark et al.’s study. Clark et al. found a non-significant difference in mean (SD) SpO₂ between feeding positions, 94 (4) % versus 92 (4) % in the semi-upright and elevated side-lying positions, respectively \( (P = 0.41) \). We also report a non-significant difference in mean (SD) SpO₂ between feeding positions, 94 (6) % versus 95 (6) % in the cradle-hold and side-lying positions, respectively \( (P = 0.55) \).

The control position used in our study is the standard cradle-hold (Fig. 1a) method of bottle feeding used at The Royal Women’s Hospital. We developed and tested a side-lying position that did not include elevating the infant as we wanted to test a feeding position that more closely resembled the position of infants during breastfeeding. The position of mother and baby during breastfeeding can vary; however, infants are often positioned across the mother’s abdomen with the infant’s head in a straight line with their body.

There is some evidence that a semi-reclining position of an infant during feeds might contribute to physiological instability. The preterm larynx and trachea are less rigid and less likely to resist airway collapse contributing to obstructive apnoea. Increasing neck flexion may increase airway resistance, predisposing a preterm infant to desaturation, bradycardia and apnoea. Byard and Burnell reported two cases of infants experiencing apparent life-threatening events while being cradled in adult arms.

We did not monitor nasal airflow and cannot accurately describe the presence or nature of hypopnoea or apnoea during feeds in our study infants. However, we speculate that the cradle-hold position may predispose infants to obstructive apnoea during bottle feeding. This requires further investigation.

We only tested the cradle-hold and side-lying positions for bottle feeding. Other positions for feeding infants have been studied. Mizuno et al. compared prone with supine positioning during bottle feeding in 14 infants, 12 full term and 2 preterm, who had oxygen desaturation during bottle feeding in the supine position. Some of the cohort had congenital abnormalities or comorbidities that might interfere with physiological stability during feeding. None of the infants demonstrated oxygen desaturation during bottle feeds in the prone position. Concerns have been raised about the loss of interaction between the feeder and the infant when using the prone position.

Strengths of our study included the consistency of the feeder for all pairs of study feeds and the training given to all feeders, nurses and parent.

Conclusion

There was no clinically significant physiological instability in oxygenation or in the frequency of bradycardia between the two feeding positions. Both feeding techniques may be appropriate for the transition from gastric tube feeding to suck feeding in preterm infants. Further investigation is required to determine if the side-lying position is beneficial for bottle feeding preterm infants.
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References


Would you include this study in an EBP project to improve pre-term infant feeding methods at transition from g-tube to oral feedings?