The effect of breast-feeding frequency on serum bilirubin levels

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OBJECTIVE: Our purpose was to evaluate the effect of breast-feeding frequency on serum bilirubin levels in the first 3 days after birth.

STUDY DESIGN: Two hundred seventy-five infants were randomly assigned to a frequent or demand breast-feeding schedule.

RESULTS: Infants in the frequent group (n = 131) nursed nine (7.5 to 10.5) times per day (median and inner 90%), and the demand group (n = 143) fed 6.5 (5.5 to 8.0) times per day. The serum bilirubin level was measured in all infants between 48 and 80 hours (median 53 hours, inner 80% 48 to 68 hours) and was 7.4 (1.8 to 10.7) mg/dl in the frequent group and 8.0 (2.9 to 11.2) mg/dl in the demand group (p = 0.103). There was no correlation between the frequency of breast-feeding and the serum bilirubin level.

CONCLUSION: Within the range of the frequency of nursing observed in this study, we could not demonstrate a significant effect on serum bilirubin levels in the first 3 days after birth. (Am J Obstet Gynecol. 1994;170:860-3.)

Key words: Breast-feeding, newborn infant, jaundice, hyperbilirubinemia

There is a strong and consistent relationship between breast-feeding and jaundice in the term newborn infant.15 Breast-fed infants are three to four times more likely to have serum bilirubin levels ≥12 mg/dl than those fed formula,17 and an inverse relationship between breast-feeding frequency during the first days after birth and maximal serum bilirubin levels has been observed.11 Because about 80% of all healthy newborns with moderate hyperbilirubinemia (serum bilirubin level ≥13 mg/dl) are breast-fed11 and because jaundice is still an issue of major concern to pediatricians and parents alike, a relatively simple intervention that might reduce the risk of hyperbilirubinemia and its potential consequences is appealing. We designed a controlled trial to evaluate the effect of breast-feeding frequency on serum bilirubin levels in the first 3 days after birth.

Material and methods

Mothers who were delivered of infants with birth weights ≥2500 gm and gestational age ≥36 weeks and who planned to breast-feed their infants were eligible for the study. After informed consent was obtained, mothers were assigned (by means of a table of random numbers) to one of two feeding schedules, frequent or demand. The assignment was made by admitting the mother to a room (occupied by one or two patients) that had previously been designated as a "frequent" or a "demand" room. If two mothers occupied the room, both were assigned to the same feeding group. All rooms were reassigned after mothers were discharged.

Immediately after admission, the mother was instructed about her feeding schedule by one of the authors and the nurse in charge. All babies were fed within 1 hour of delivery. For the frequent group, mothers were asked to feed their infants at least every 2 hours during the day and no less than every 3 hours at night. In the demand group, mothers were asked to feed whenever the infant cried or appeared to be hungry. Mothers and nurses kept a record of the number of breast-feedings, the time of the first stool, frequency of stools and the administration of supplemental feedings. (Dextrose water was given only if requested by the mother.) Babies remained in their mother's rooms for 24 hours a day throughout the hospital stay. Nurses on all shifts received detailed instructions and encouraged each group of mothers to follow their assigned feeding schedule. The study was approved by the Committee of Clinical Research and Human Studies of the Sanatorio Guemes, Buenos Aires.

Sample size. On the basis of a previous study com-
paring formula-fed with breast-fed infants we chose an effect size of 1.2 mg/dl for the difference between the maximal serum bilirubin levels in the two groups. For an a of 0.05 (5% risk of a type I error, two-tailed) and a B of 0.1 (10% risk of a type II error) 116 patients were needed in each group.

Patients. Mothers and infants were enrolled between Sept. 1, 1989, and Jan. 31, 1990. Two hundred seventy-eight newborn infants with a birth weight ≥2500 g and a gestational age ≥36 weeks were enrolled. Infants meeting the following criteria were excluded: ABO or Rh incompatibility with a positive Coombs's test, congenital anomalies, twin pregnancies, Asian race, and infants separated from their mothers for >6 hours during the first 2 days (for maternal or neonatal indications). Serum bilirubin levels were measured in cord blood and again between 48 and 72 hours after birth from a capillary sample obtained at the same time that a sample was being drawn for metabolic screening. (In one infant this measurement was performed at age 80 hours.) The bilirubin levels were measured (Mochida D-Luktron Bilimeter, model NEP332) by one of the authors who was blind to all clinical information. The coefficient of variation of this instrument was 0.9%, and the machine was calibrated before each measurement.

A separate investigator compared a clinical history with particular reference to factors known to affect bilirubin levels in the newborn.14

Statistical analysis. Continuous variables were analyzed with the Mann-Whitney test and regression analysis. The Mann-Whitney U test was used instead of the t test because of outliers and because normal bilirubin values were skewed toward the lower range. Categoric data were compared with the Fisher exact test.

Results

Two hundred seventy-eight infants were eligible for the study. Two were excluded because of failure to obtain parental consent and one because of ABO hemolytic disease identified after randomization. Of the remaining 275 infants, 131 were assigned to the frequent group and 144 to the demand group. There were no significant differences between the groups for any of the following: maternal age, gravidity, blood type, smoking during pregnancy, use of oxytocin in labor, premature rupture of membranes, presentation, delivery method, use of anesthetics, and Apgar scores. There were also no differences between the two groups with regard to birth weight, gestation, sex, cord bilirubin level, the age at which the second bilirubin sample was obtained, and number of stools passed per 24 hours. Dextrose water supplements were fed (on mother's request) to 21% of the demand group and 11% of the frequent group (p = 0.046 Fisher exact test, two-tailed). Surprisingly, babies in the frequent group lost more weight (p = 0.037) than those in the demand group (Table I).

Infants in the frequent group nursed 9.0 (7.5 to 10.5) times per day, and the demand group fed 6.5 (5.5 to 8.0) times per day (medians and inner 80%). The serum bilirubin level (measured between 48 and 80 hours) was 7.4 (1.8 to 10.7) mg/dl in the frequent group and 8.0 (2.9 to 11.2) mg/dl in the demand group (p = 0.103). There was no correlation between the frequency of breast-feeding and the serum bilirubin level attained between 48 and 80 hours in either group (frequent, R² = 0.002, p = 0.643; demand, R² = 0.007, p = 0.317) (Figs. 1 and 2).

Comment

Mothers who nurse more frequently have better milk production,15 and for this reason alone frequent nursing should be encouraged. We were disappointed, however, that we did not find a greater impact of frequent nursing on serum bilirubin levels; nor was there any correlation between the frequency of nursing and maximal bilirubin levels (Figs. 1 and 2). We also compared bilirubin levels at the extremes of feeding frequency. The median bilirubin level in infants fed ≥10 times per day (n = 45) was 7.2 (1.7 to 10.0) mg/dl compared with 7.6 (2.7 to 11.7) mg/dl in those fed 6 times per day or less (n = 49, p = 0.189). There was no difference in the proportion of infants in each group whose serum bilirubin levels were ≥20.0 mg/dl (5.3% frequent, 4.2% demand) or ≥15.0 mg/dl (2.3% frequent, 2.5% demand).

The only significant difference between the groups (other than the feeding frequency) was the use of dextrose water supplements (which were given in response to maternal request to 11% of the frequent feeders and 21% of the demand feeders); the percent weight loss (5.5% vs 4.8%), and the median age at bilirubin measurement (50 vs 55 hours). The demand-fed babies were older when the bilirubin levels were measured. This would tend to increase bilirubin levels, as would supplemental dextrose water feedings (contrary to popular belief). Controlled trials have shown that breast-fed babies who receive water or dextrose water supplements have higher bilirubin levels than do unsupplemented infants.16 If anything, these two factors would bias the results in the direction of increasing the differences between the frequent and demand feeders. On the other hand, the frequent feeders lost more weight, a factor associated with an increase in bilirubin levels.17 Whether this is cause or effect, it might tend to narrow the differences between the two groups.

To our knowledge, this is the first controlled trial of the effect of breast-feeding frequency on bilirubin levels in the newborn. It was conducted at the Eunice Kennedy Shriver National Institute of Child Health and Human Development, Bethesda, Maryland.
Fig. 1. Serum bilirubin concentration at age 48 to 80 hours plotted against number of breast-feedings per 24 hours in frequency group. Regression analysis revealed no linear relationship between frequency of feeding and bilirubin levels. $R^2 = 0.002, p = 0.643$.

Fig. 2. Serum bilirubin concentration at age 48 to 80 hours plotted against number of breast-feedings per 24 hours in demand group. Regression analysis revealed no linear relationship between frequency of feeding and bilirubin levels. $R^2 = 0.007, p = 0.371$.

Table 1. Clinical data in study population

<table>
<thead>
<tr>
<th></th>
<th>Frequent feeding (n = 132)</th>
<th>Demand feeding (n = 143)</th>
<th>Significance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth weight (g)</td>
<td>3380 (2830-3850)</td>
<td>3250 (2800-3850)</td>
<td>$p = 0.248$</td>
</tr>
<tr>
<td>Female (%)</td>
<td>52.7</td>
<td>54.9</td>
<td>$p = 0.617$</td>
</tr>
<tr>
<td>Gestation (wk)</td>
<td>39 (38-41)</td>
<td>39 (38-41)</td>
<td>$p = 0.726$</td>
</tr>
<tr>
<td>No. of feedings per 24 hr</td>
<td>9 (7.5-10.5)</td>
<td>6.5 (5.5-8.0)</td>
<td>$p = 0.006$</td>
</tr>
<tr>
<td>Supplemental dextrose water (%)</td>
<td>11</td>
<td>21</td>
<td>$p = 0.004$</td>
</tr>
<tr>
<td>No. of stools per 24 hr</td>
<td>4 (2-7)</td>
<td>4 (2-7)</td>
<td>$p = 0.281$</td>
</tr>
<tr>
<td>Time first stool (hr)</td>
<td>12 (3-26)</td>
<td>11 (5-22)</td>
<td>$p = 0.18$</td>
</tr>
<tr>
<td>Percent weight loss</td>
<td>5.5 (2.2-8.7)</td>
<td>4.8 (2.4-8.2)</td>
<td>$p = 0.637$</td>
</tr>
<tr>
<td>Cord bilirubin (mg/dl)</td>
<td>1.6 (0.9-2.1)</td>
<td>1.7 (1.3-2.2)</td>
<td>$p = 0.474$</td>
</tr>
<tr>
<td>Serum bilirubin (mg/dl)</td>
<td>7.4 (1.8-10.7)</td>
<td>8.0 (2.9-11.2)</td>
<td>$p = 0.103$</td>
</tr>
<tr>
<td>Age at bilirubin (hr)</td>
<td>50 (48-65)</td>
<td>55 (48-70)</td>
<td>$p = 0.03$</td>
</tr>
<tr>
<td>Change in bilirubin (mg/dl)</td>
<td>5.5 (0.8-8.9)</td>
<td>5.9 (1.6-9.4)</td>
<td>$p = 0.450$</td>
</tr>
<tr>
<td>Bilirubin ≥ 12.0 mg/dl (%)</td>
<td>3.3</td>
<td>4.2</td>
<td>$p = 0.799$</td>
</tr>
<tr>
<td>Bilirubin ≥ 13.0 mg/dl (%)</td>
<td>2.3</td>
<td>2.8</td>
<td>$p = 1.00$</td>
</tr>
</tbody>
</table>

Values shown as medians, 10th to 90th percentiles (inner 80%). 1 mg/dl = 17.1 μmol/L.

*Mann-Whitney or Fisher exact test.

*Measured between 48 and 80 hours.

*Difference between serum bilirubin at 48 to 80 hours and cord bilirubin.

"Cuenca in Buenos Aires because there newborn infants remain in the hospital for 3 days after birth, whereas in the United States most are discharged by 48 hours."

We measured bilirubin levels on the third day because we could not do so once the infant had been discharged. It is possible that by 50 to 55 hours maximal bilirubin levels had not yet been achieved. Maximal bilirubin levels in breast-fed infants occurred on day 3 in one study. In another study peak levels occurred by day 2 and remained at that level until day 5. Yamauchi and Yamanouchi found that the incidence of hyperbilirubinemia was significantly decreased on the sixth day after birth in infants who fed at least nine times or more in the first 24 hours. Others have found an inverse relationship (which we could not confirm) between breast-feeding frequency and bilirubin levels."
is possible, but not certain, that frequent nursing actually achieved a more significant effect, but this was missed because we were unable to measure bilirubin levels on days 4 or 5. A difference at age 4 to 5 days would be clinically important because it is at that age that nursing is often interrupted, home phototherapy initiated, or infants admitted to the hospital when bilirubin levels reach 17.0 to 20.0 mg/dl.17

There are many reasons to encourage mothers to nurse their babies frequently. Within the range of nursing frequency observed in this study, however, it is unlikely that more frequent nursing will have a significant effect on serum bilirubin levels in the first 3 days after birth.

REFERENCES