

Breast Feeding and Jaundice in the First Week of Life

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Infants who most commonly receive treatment for neonatal hyperbilirubinemia are breast-fed babies in whom no cause for the jaundice can be determined. Hyperbilirubinemia in these newborns may not be caused by the breast feeding as such, but rather by inadequate nursing. This paper reports attempts to decrease readmissions for phototherapy at the UCLA Medical Center by inducing earlier and more functional lactation in the entire nursery population and by formula feeding infants whose bilirubins approached recommended treatment levels. Nursing was interrupted for 24 to 48 hours in 87 newborns; six still required readmission, while 81 were successfully treated at home.

At the two-week well-baby visit, no differences in the incidence of breast feeding were found when comparing nonjaundiced breast-fed babies with infants who were taken off the breast or who were readmitted for phototherapy. Differences in the cost of care were significant with an average cost per patient of \$126 for those treated at home compared with \$1,440 for those readmitted.

Policies designed to induce earlier lactation did nothing to decrease the incidence of exaggerated jaundice in the study's breast-fed population. It was concluded that a short interruption of breast feeding, if done in a controlled supervised setting with careful counseling and follow-up, can provide an effective alternative to readmission and phototherapy in the treatment of jaundice.

The relationship between prolonged unconjugated hyperbilirubinemia and breast feeding has been known since Arias and colleagues described the syndrome in 1963.¹ The association between nursing and early-onset jaundice, however, is con-

troversial.^{2,3} Two recent studies have demonstrated a definite increase in the incidence of exaggerated jaundice among breast-fed neonates during the first week of life.^{4,5} The cause of the early-onset syndrome is unknown. Two plausible explanations are that the hyperbilirubinemia is secondary to increased enterohepatic circulation of bilirubin or is caused by a direct effect of relative caloric deprivation.^{6,7} In either case the early-onset syndrome would not be caused by the breast

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Table 1. Criteria for Follow-Up and Treatment of Nonhemolytic Jaundice

Category	Age	Total Bilirubin Level (mg %)
Outpatient follow-up	≥36 hr	≥9
	>48 hr	>10
	≥72 hr	≥11
Jaundice workup	any age	≥14
Treatment		
Discontinuation of breast feeding	<5 d	14
Phototherapy	<24 hr	14
	>24 hr	15

milk per se, but rather by infrequent or inadequate nursing.

If, indeed, inadequate nursing does cause jaundice, readmissions for phototherapy could be decreased either by inducing earlier and more functional lactation in an entire population or, as has been previously suggested,^{8,9} by providing calories through formula feeding in those infants whose bilirubins approach recommended treatment levels.

The purpose of this paper is to report findings regarding (1) the efficacy of removing infants from the breast as an alternative to readmission and phototherapy, (2) the effects of interruption of breast feeding on eventual breast-feeding success, and (3) the effects of a breast-feeding protocol designed to induce early lactation.

Methods

All infants admitted to the normal newborn nursery at the UCLA Medical Center between July 1, 1981, and December 31, 1982, were followed prospectively for the development of exaggerated jaundice. Infants were not randomized; all were followed by a protocol designed to assist residents and nurses in the management of jaundiced neonates. A detailed description of the protocol used for detection and follow-up of hyperbilirubinemia in these newborns has been previously published.⁴

The population described in this report consists of all breast-fed infants born during this period who, after initial hospital discharge, were treated

for jaundice. Treatment consisted either of interruption of breast feeding or readmission and phototherapy. Infants were excluded if they were less than 36 weeks' gestation by Ballard examination,¹⁰ weighed less than 2,500 g at birth, or were ill enough to require transfer to the neonatal intensive care unit. To assess the impact of treatment for jaundice on eventual breast-feeding success, a control group was gathered by selecting 105 consecutively born breast-fed infants who met the study inclusion criteria but did not become jaundiced. No comparison newborns had serum bilirubins of greater than or equal to 10 mg percent.

All infants whose bilirubin levels met the criteria listed in Table 1 were followed daily in the outpatient clinic until the serum bilirubin concentration stabilized or reached recommended treatment levels.¹¹ A thorough search for a cause for the jaundice was conducted on all newborns whose serum bilirubins were greater than or equal to 14 mg percent, including a careful history and physical examination, thyroid and galactosemia screening, a complete blood count with a peripheral smear, infant's and mother's blood type, infant's indirect Coombs' test, and a urinalysis. If a spun urine contained more than 10 white cells per high power field or if bacteria were seen on an unspun specimen, a urine sample was cultured.

Parents of breast-fed infants whose bilirubin levels, subsequent to discharge, rose to 14 mg percent or more were advised to discontinue breast feeding. A trained nurse explained that the cessation of breast feeding was temporary and that the milk could be frozen for future use. The nurse then instructed the mother how to express her milk manually. Breast pumps were provided if desired. Infants were given formula feedings every two hours. For neonates whose levels were greater than or equal to 15 mg percent but less than 17 mg percent, a six-hour trial of bottle feeding was conducted in the clinic. If the bilirubin concentration continued to rise, the baby was admitted for phototherapy. If the level stabilized, the baby was sent home on frequent formula feedings and returned the following day for reevaluation. When the child's bilirubin level dropped by 2 mg percent or more, the mother was instructed to resume breast feeding. Infants who upon presentation in the clinic had serum bilirubins greater than or equal to 17 mg percent were directly admitted for

Table 2. Comparison of Breast-Feeding Policies July 1, 1981—June 14, 1982, and June 14, 1982—December 31, 1982

July—June	June—December
First Feeding Water at 2 to 4 hours Breast feeding at 4 to 8 hours	Breast feeding at birth
Schedule Feeding at 2 to 6 hours on demand	Same
Night feeding optional (most infants given water or formula by nurses at night)	All infants breast feeding through night at least once and on demand
Supplementation Water after each feeding	None

phototherapy without a trial of bottle feeding.

In an attempt to facilitate nursing and induce earlier lactation, a new policy for instruction of breast-feeding mothers was introduced on June 15, 1982. Differences between this policy and the policy adhered to between July 1, 1981, and June 14, 1982, are listed in Table 2. Major differences included earlier first feedings, cessation of routine water supplementation after feedings, and insistence that all nursing mothers breast feed their newborns at least once during the night.

Statistical Analysis

To assess the effects of removing infants from the breast, the following comparisons were made between untreated newborns and infants treated for jaundice by interruption of breast feeding or by readmission and phototherapy. The *t* test was used for comparison of the continuous variables of birth weight and length, gestational age, weight loss, maximum bilirubin level, age at peak bilirubin level, age at institution of therapy, and length of therapy. The incidence of breast feeding at two weeks of age was assessed using the chi-square method. Cost data are included describing the average expense of treatment using interruption of nursing vs readmission and phototherapy.

The effects of changes in breast-feeding policies were assessed using the chi-square method to compare the incidence of treatment for jaundice before and after institution of the new protocol. Analysis of variance was used to compare the

maximum bilirubin levels and weight loss during the two time periods.

Results

Between July 1, 1981, and December 31, 1982, 2,786 qualifying neonates were admitted to the UCLA Hospital Normal Newborn Nursery. The incidence of breast feeding remained stable throughout the study period at 71 nursing infants per 100 admissions (71 percent). During the 18-month study period, 108 breast-fed babies were treated for jaundice after discharge. Nursing was interrupted in 87 cases, while 21 babies were readmitted without a trial of bottle feeding. Six of the 87 babies were readmitted when bottle feeding failed to stabilize the serum bilirubin level. Three of the six were found to have hemolytic disease. Two babies with ABO incompatibility, initially reported to be indirect Coombs' negative, were found to be Coombs' positive on readmission. Both were slightly anemic and had peripheral smears compatible with hemolysis. The third infant was found to have G6PD deficiency. Comparison of treated and untreated neonates are found in Table 3. The two groups were of comparable length and gestational age, but treated infants weighed less at birth and subsequently lost more weight than untreated ones.

Figure 1 displays the average daily bilirubin levels of infants who were readmitted and treated with phototherapy and those in whom nursing was

Table 3. Breast-Fed Newborns: Comparison of Untreated Infants With Those Treated for Neonatal Jaundice After Initial Discharge

Variable	Treated	Untreated	P Value
Mean gestational age	39.4 ± 1.7 wk	39.7 ± 1.4 wk	.11
Mean birth-weight	3400 ± 409 g	3592 ± 492	.002
Mean length	50.8 ± 2.3 cm	51.2 ± 2.6 cm	.37
Weight length ratio	66.5 ± 6.0	70.1 ± 7.7	.001
Mean weight loss	4.9% ± 2.7%	3.4% ± 2.1%	.0001

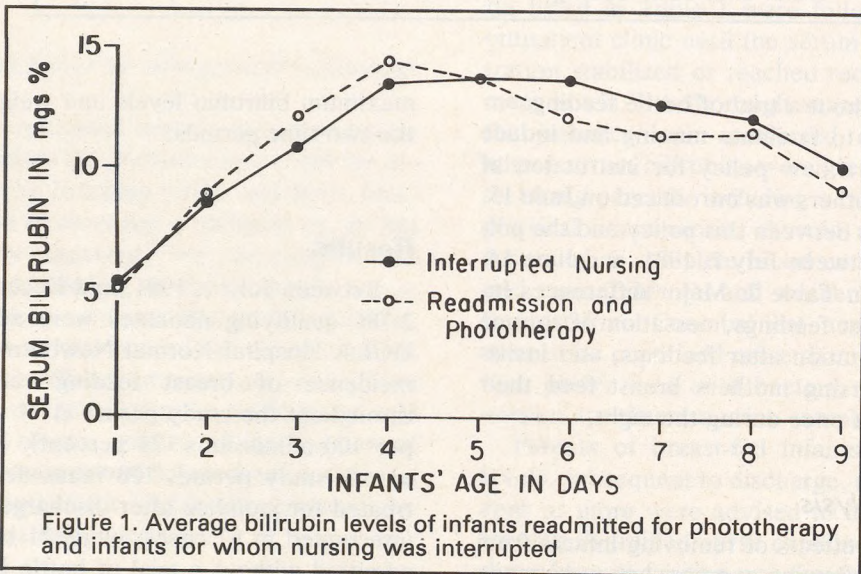


Table 4. Infants Treated by Interruption of Breast Feeding Compared With Infants Treated by Readmission and Phototherapy

Variable	Interrupted Nursing	Readmission	P Value
Mean maximum bilirubin	15.0 ± 1.3 mg%	18.0 ± 1.8 mg%	.0001
Day of maximum bilirubin	4.1 ± 1.1 d	4.4 ± 2.5 d	.35
Length of treatment	49.1 ± 20 hr	36.4 ± 18 hr	.01
Mean cost of care	\$126	\$1,440	

Table 5. Type Feeding at Two-Week Well-Baby Visit: Comparison of Untreated Newborns With Babies Treated by Interruption of Nursing and/or Readmission*

Treatment Group	Type Feeding				Total
	No Visit	Bottle	Breast	Breast and Bottle	
Untreated	44	28	23	10	105
Interrupted nursing	19	23	24	13	79
Readmitted	6	5	11	5	27
Total	69	56	58	28	211

$$\chi^2 = 11.72; df = 6; P > .05$$

*All infants were discharged from the hospital as breast-feeding babies.

interrupted. The curves are comparable and indicate no difference in the rate of bilirubin rise in the two groups. Table 4 compares babies treated by interruption of breast feeding with those who were readmitted for phototherapy. Readmitted babies had higher mean peak bilirubin levels and were treated for a shorter period of time, but they incurred significantly greater costs than those who were removed from the breast.

To assess the effect of interruption of nursing on eventual breast-feeding success, the type of feeding at the two-week well-baby visit was compared among nonjaundiced breast-fed infants, breast-fed newborns treated by interruption of nursing, and breast-fed newborns who were treated by readmission and phototherapy. Of the cohort, 142 of 211 (67 percent) returned for a two-week visit. No data are available for those who did not return. As demonstrated in Table 5, no differences were found in the method of feeding at the two-week well-baby visit when comparing untreated babies with those treated by interruption of nursing or by readmission and phototherapy.

Changes in breast-feeding policy did not affect the incidence of treatment for jaundice in this breast-feeding population. During the first 12 study months, 19 breast-fed infants were readmitted and 59 were removed from the breast. In the six months following the policy changes, 8 babies were readmitted and 28 removed from the breast. Although treated infants lost slightly more weight after water supplementation was stopped (5.3 percent vs 4.9 percent), the difference was not significant ($F = .99; P > F = .40$).

Discussion

The purpose of this investigation was to assess the treatment and outcome of exaggerated jaundice in breast-fed neonates. The strengths of the study include the large number of infants in the cohort, the application of a consistent treatment, and the thorough follow-up of cases. The major weakness is that infants were not randomly assigned to treatment groups; treatment was prescribed according to the infant's serum bilirubin level. Thus, although these findings suggest an effective therapy, they do not prove this to be the case.

A good response to interruption of breast feeding was seen in over 90 percent of infants whose serum bilirubin levels approached those currently recommended for phototherapy. Of the few infants who failed a trial of bottle feeding, 50 percent were found to have an underlying process that caused the jaundice. Comparison of infants who ceased nursing with those receiving phototherapy revealed no difference in the rate of rise of the pretreatment serum bilirubin. Thus, although infants were not randomly assigned to treatment groups, it appears highly likely that most of these newborns would have been readmitted.

Interruption of breast feeding offered several advantages over readmission and phototherapy. Families suffered less disruption because the infants were treated at home. There was a large cost differential between the two therapies: \$126 average cost per patient for cessation of nursing vs \$1,440 for readmission and phototherapy. Finally, infants treated by a short course of bottle feed-

ing may avoid some of the behavioral changes described in neonates who have undergone phototherapy.¹²

The main potential risk of interruption of nursing during the first week of life is that this interruption will interfere with successful breast feeding. Although a discouragingly large number of babies were bottle feeding at the two-week well-baby visit, this was true for all infants. That no difference in the incidence of breast feeding was found between treated and untreated neonates is attributed to the careful counseling given to parents.

Policies that attempted to induce earlier and more functional lactation did nothing to decrease the incidence of exaggerated jaundice in the general population; however, two study findings suggest that the jaundiced breast-fed infants in this study are, in fact, a special group. These newborns were both significantly smaller and lost more weight than their nonjaundiced counterparts. The difference in weight loss, although highly statistically significant, is so small it is clinically unimportant, which strongly suggests a secondary, non-causal correlation between the two factors. It is postulated that the weight loss reflects a qualitative difference in the breast feeding of icteric and nonicteric newborns.

Several studies have demonstrated a relationship between feeding practices and jaundice.^{13,14} Early feeding is associated with a decreased incidence of hyperbilirubinemia. Although the mechanism for the jaundice is debated, with some investigators attributing it to increased enterohepatic circulation and others to a direct effect of caloric deprivation, the clinically relevant fact is that milk in sufficient quantities can avert a rise in an infant's serum bilirubin level.¹⁵ One explanation for these findings is that smaller infants nurse less frequently, do not stimulate an adequate milk supply, and are, therefore, more likely to develop exaggerated jaundice. This hypothesis is supported by the recent findings of DeCarvalho et al,⁷ who demonstrated a direct relationship between the frequency of nursing and serum bilirubin concentration. Compared with infants who fed more frequently, newborns nursing eight times a day or less had higher serum bilirubin concentrations. They also weighed an average of 193 g less, a weight difference identical to that found in this study.

The need for phototherapy in full-term, healthy breast-fed neonates has recently been ques-

tioned.¹⁶ Certainly this basic issue deserves further investigation. However, as long as current recommendations are used, findings of this study can assist practitioners in the management of early-onset jaundice in breast-fed babies. First, interruption of nursing can be an effective alternative treatment for neonatal hyperbilirubinemia, and, if done with proper counseling, it need not interfere with successful breast feeding. Second, a trial of bottle feeding can be diagnostic; an especially careful search for an underlying cause of the jaundice is indicated in all breast-fed newborns who do not respond to such a trial. Finally, attempts to decrease the incidence of early-onset jaundice associated with breast feeding should be continued with special attention directed to smaller newborns. Every effort should be made to encourage these babies to nurse frequently.

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