

# Umbilical Cord Bilirubin Levels as a Predictor of Subsequent Hyperbilirubinemia

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*Serum cord total bilirubin levels can define a subgroup of infants who are at a higher risk for developing significant hyperbilirubinemia and requiring phototherapy. Infants with cord bilirubin levels less than 2.0 mg/dL have only a 4 percent chance of developing hyperbilirubinemia and a 1.4 percent chance of needing phototherapy. However, if serum cord bilirubin levels are more than 2.0 mg/dL, the infant has a 25 percent chance of developing subsequent hyperbilirubinemia. With early discharge from the nursery a more common practice, this level can identify at an early age those infants who need closer follow-up.*

Since early discharge of the mother and infant from the hospital after delivery has become a more accepted procedure, a test that could predict subsequent hyperbilirubinemia and the need for further close observation is important. Because the newborn is often discharged before 24 hours old, and significant hyperbilirubinemia may not develop until day 3 of life, an early test to specify infants at risk would allow for more efficient follow-up.

Hyperbilirubinemia is a continuing and serious problem in the newborn nursery. Six percent of full-term infants will have bilirubin levels greater than 12.9 mg/dL within 72 hours of age, and 20 percent of all infants will have bilirubin levels between 8.0 and 12.9 mg/dL. A test to predict hyperbilirubinemia should be easy to obtain, noninvasive, available within 24 hours of birth, and inexpensive. Use of carbon monoxide concentrations in a mixed end-expiration gas collection of an end-tidal sample, with measurement of transcutaneous bilirubin, has been proposed as a predictor of significant jaundice.<sup>1</sup> However, this test, which requires sophisticated instrumentation and highly trained technicians, has a significant cost. Cord blood bilirubin levels have previously been reported to be of little predictive significance.<sup>2</sup>

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This study had a very high rate of infants requiring phototherapy. Eighty-seven of 182 infants, or 47 percent, required phototherapy, much higher than the expected 6 to 20 percent, suggesting an unusual population of infants.

In this study, however, measurement of umbilical cord total bilirubin levels in normal, full-term infants predicted those who were more likely (1) to develop bilirubin levels greater than or equal to 10 mg/dL and (2) to require phototherapy.

## METHODS

In a four-year period from July 1981 to July 1985, 325 infants were delivered by this author in Union Hospital of Cecil County, Maryland, a rural community hospital. The charts of 108 infants were chosen randomly, and all charts with the last two digits of the hospital's filing number 01 to 25 were studied. The hospital uses a modified social security number for filing purposes. Thus chart number 000-00-1000 was followed by chart number 000-00-1100. However, baby 1100 was born 100 deliveries after 1000. All charts were inspected retrospectively. All deliveries routinely had cord bilirubin levels, blood types, and direct Coombs' tests ordered, although precipitous deliveries and intradelivery problems at times prevented obtaining cord blood samples. All charts were investigated for mother's age, gestational age at delivery, prenatal problems, delivery problems, mother's and infant's blood types, and cord hemoglobin and bilirubin levels.

All infants were cared for in the nursery and follow-

**TABLE 1. RISK OF SUBSEQUENT HYPERBILIRUBINEMIA IN INFANTS ACCORDING TO CORD BILIRUBIN LEVELS**

Infant Outcome	Bilirubin Levels	
	< 2.0 mg/dL No. (%)	≥ 2.0 mg/dL No. (%)
Subsequent bilirubin levels 10 mg/dL at 48 hours old	3 (4)	8 (5)*
Phototherapy needed	1 (1.4)	7 (22.5)*
Total	68 (68)	31 (32)

\*P ≤ .01 (corrected chi-square)

**TABLE 2. RISK FACTORS OF INFANT'S CORD BILIRUBIN LEVELS**

	< 2.0 mg/dL No. (%)	≥ 2.0 mg/dL No. (%)
Primiparas	32 (47)	18 (58)
Adolescent mothers	20 (29)	14 (45)
Preterm deliveries 35 to 36 weeks	2 (3)	4 (13)

*Note: Not one of the results is statistically significant*

ing hospitalizations by the author. At evidence of clinical jaundice in the nursery, heel-stick capillary total bilirubin levels were obtained. Once bilirubin levels were found to be elevated, repeat levels were obtained two times daily until they measured below 8 mg/dL. Phototherapy was initiated at 14 mg/dL. At that time, a full workup for causes of hyperbilirubinemia was initiated, including complete blood counts, blood and urine cultures, liver functions tests, and other necessary tests.

Significant hyperbilirubinemia was defined as bilirubin levels of 10 mg/dL or greater in a full-term infant aged less than 48 hours or levels greater than 12 mg/dL at 72 hours of age. Hyperbilirubinemia requiring phototherapy was defined as a bilirubin level of 14 mg/dL or higher.

**RESULTS**

The charts of 108 infants were examined. The infants were all older than 35 weeks' gestational age at the time of delivery. Less mature infants had been transferred to a facility with a higher level intensive care nursery. Six children were born between 35 and 37 weeks' gestational age. One hundred two infants were 37 weeks' gestational age or older at the time of delivery. Fifty-three of the infants (50 percent) were born to primigravida mothers. Thirty-six (33 percent) were born to teenaged mothers.

These infants were assigned to two groups according to their cord serum bilirubin levels. Nine infants had no bilirubin levels recorded. Of the remaining 99 infants, there were 68 (68 percent) who had bilirubin levels of 1.9 mg/dL or less at birth. Thirty-one infants (32 percent) had levels of 2.0 mg/dL or more. This level of 2.0 mg/dL had prognostic significance.

In the group of infants with bilirubin readings of 2.0 mg/dL or more at birth, 25 percent developed hyper-

bilirubinemia at levels of 10 mg/dL or more. In contrast, those infants with cord bilirubin readings of 1.9 mg/dL or less were much less likely to develop hyperbilirubinemia. Only three of the 68 (4.4 percent) had significantly high levels. Furthermore, those infants with the higher cord bilirubin levels were much more likely to need phototherapy. Of the 31 infants with cord bilirubin levels greater than 2.0 mg/dL, 7 (22.5 percent) required phototherapy compared with only 1 of the 68 infants with the lower cord bilirubin levels (Table 1). This figure is statistically significant.

The group of infants with higher cord bilirubin levels were more likely to be the children of primiparous adolescent mothers. Fifty-eight percent of infants with bilirubin levels of greater than 2.0 mg/dL were born to adolescent mothers, with only 29 percent of those with bilirubin levels less than 2.0 mg/dL. None of the children had ABO incompatibilities with positive direct Coombs' tests. Not one of the children was noted to have severe bruising. Six percent of infants in both groups had hemoglobin levels greater than 20 mg/dL. None of those infants with hemoglobin levels greater than 20 mg/dL developed hyperbilirubinemia (Table 2).

**CONCLUSIONS**

Cord total bilirubin levels were an inexpensive, easily obtainable, and fairly sensitive indicator of subsequent hyperbilirubinemia in the newborn period. Levels of 2.0 mg/dL or more indicate a greater likelihood of developing significant hyperbilirubinemia requiring phototherapy. These levels are obtained at birth, and can be easily available before the discharge of the infant, even before it is 24 hours old. The levels will allow the family physician or pediatrician to identify that group of infants at higher risk who thus should be followed up soon in an office visit.

**DISCUSSION**

Hyperbilirubinemia is a significant problem in the

newborn nursery. With early discharge a common occurrence, early identification of infants who may be at higher risk for clinical jaundice, hyperbilirubinemia, and phototherapy is important. Umbilical cord total bilirubin levels seem to be a sensitive indicator of subsequent hyperbilirubinemia. The test for bilirubin levels is relatively inexpensive; in one laboratory the test cost was \$11.

Ninety-nine infants had cord bilirubin levels recorded. If their cord total bilirubin levels were less than 2.0 mg/dL, only 4 percent had subsequent significant hyperbilirubinemia. Only one child whose cord bilirubin level was less than 2.0 mg/dL required phototherapy. If the child had a cord bilirubin level of greater than or equal to 2.0 mg/dL, however, he was six times more likely to develop significant hyperbilirubinemia; eight of 31 (25 percent) developed hyperbilirubinemia. The infants of this group were more likely to require phototherapy. Seven of 31 (22.5 percent) with high cord bilirubin levels required phototherapy compared with only one of 68 who had lower cord bilirubin levels. These differences, both for developing bilirubin levels greater than 10 mg/dL and for requiring phototherapy, were statistically significant. Thus cord bilirubin levels defined a subgroup of infants, 31 of 99 (31 percent) who were at higher risk for significant hyperbilirubinemia and phototherapy. This test would allow physicians to predict which infants may need closer follow-up after early discharge.

None of the children in either subgroup had severe bruising, clinical ABO incompatibility, or hemolytic anemias with positive direct Coombs' tests. Equal percentages of children in both groups, 6 percent, had high hemoglobin levels. Thus, these findings cannot be

explained by these independent causes of hyperbilirubinemia.

Early follow-up in the physicians' offices is recommended by the American Academy of Pediatrics for infants who are discharged after birth before 72 hours of age. This test would not supplant such necessary follow-up, but gives the physician one further indication of possible future problems. As well, such follow-up may not always be possible for all patients, especially in large clinic populations. Identification of children at higher risk might provide more efficient follow-up and prevent hospitalization just for observation. Although a positive value, a high cord bilirubin level, has a high false-positive rate, a negative value or a low cord bilirubin level has a 98.5 percent predictive value. With a low cord bilirubin level, the physician can feel more confident at the safety of early discharge concerning hyperbilirubinemia.

This study was retrospective, and it did depend on clinical judgment of jaundice for further determination of hyperbilirubinemia in the nursery. Since these infants did remain in the nursery for three days and because they were cared for following hospitalization by the author, it is unlikely that any significant hyperbilirubinemia was missed.

#### References

1. Smith DW: Use of noninvasive tests to predict significant jaundice in full-term infants; preliminary studies. *Pediatrics* 1985; 75:278-280
2. Jacobson M, Bernstein H: Limited diagnostic value of routine cord blood bilirubin determinations. *Clin Pediatr* 1982; 21(10):610-612