



PREDICTION OF SIGNIFICANT HYPERBILIRUBINEMIA IN TERM NEWBORNS USING CORD BLOOD BILIRUBIN

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ABSTRACT

Aims: The present study was done to assess the usefulness of the cord blood bilirubin estimation as a predictor of subsequent neonatal hyperbilirubinemia in a healthy term infants who require phototherapy.

Setting and Design: A prospective cohort study was conducted at tertiary care centre. 100 term newborn delivered by LSCS was included in this study.

Methods and Materials: 5ml of blood was collected from umbilical cord during delivery. It was used for estimation for conjugated, unconjugated, total serum bilirubin levels and blood group. All enrolled babies were followed up for 5 days and clinically assessed for jaundice according to Kramer dermal scale. In these babies, bilirubin estimation was done on samples collected at birth (cord blood), at 72 hrs. of life (3rd day), at 120 hrs. of life (5th day).

Results: Cord blood bilirubin level of more than 2.15mg/dl has a sensitivity of 65% and specificity of 65% in prediction of neonatal hyperbilirubinemia. Babies having serum cord bilirubin level of >2.15mg/dl can be followed up in the hospital for 5 days, the time of peak neonatal hyperbilirubinemia to prevent the babies discharged early and later readmission for neonatal hyperbilirubinemia.

Conclusion: It is recommended to have cord blood bilirubin estimation of all healthy term babies delivered in an institution to prevent the dangerous consequences of neonatal hyperbilirubinemia like Kernicterus.

Key Words: Neonatal hyperbilirubinemia, Cord blood bilirubin

INTRODUCTION

Neonatal Hyperbilirubinemia¹ is one of the most common cause for admissions in neonatal unit. Early discharge of healthy term babies from the hospitals is increased due to medical, social and economic reasons. The risk of re-admission² due to jaundice is increasing. The recognition, follow up and early treatment of jaundice has been difficult as a result of early discharges. The American Academy of Pediatrics⁵ recommends that newborns discharged within 48 hours should have a follow-up visit after 2-3 days to detect significant jaundice and other problems. This recommendation is not possible in our country due to limited follow up facilities in the community. The concept of early prediction of jaundice would facilitate safe and cost-effective targeted intervention and follow-up. The timely detection of neonatal hyper-

bilirubinemia⁹⁻¹² and optimal management are crucial to prevent brain damage and subsequent neuromotor retardation due to bilirubin encephalopathy⁶. Examination of newborns, cord blood bilirubin level is a non invasive procedure and can increase early detection to prevent severe hyperbilirubinemia.

MATERIAL AND METHOD

A prospective cohort study was conducted in department of pediatrics at tertiary care centre. 100 term newborn delivered by LSCS was included in this study. Newborn with congenital malformation were excluded. Other exclusion criteria include infant born to diabetic mother, neonatal sepsis, Rh incompatibility¹³ and conjugated jaundice.

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5ml of blood was collected from umbilical cord during delivery. It was used for estimation for conjugated, unconjugated, total serum bilirubin levels and blood group. All enrolled babies were followed up for 5 days and clinically assessed for jaundice according to Kramer dermal scale². In these babies, bilirubin estimation was done on samples collected at birth (cord blood), at 72 hrs. of life (3rd day), at 120 hrs. of life (5th day).

Maternal variables like history of jaundice, first trimester bleeding, gestational hypertension, mode of delivery and uses of drugs during pregnancy were collected. Medication during labour, details of delivery, APGAR score and maternal blood group were recorded.

Babies were examined daily and looked for evidence of jaundice, sepsis, illness or birth trauma. Weight of the newborn was recorded and gestational age calculated. All the babies were followed up daily for first 5 postnatal days.

Serum bilirubin estimation was done within 12 hours of collection of sample by Diazotized sulfanilic test (Jendrassik modified method).

The main outcome of the study was inferred in terms of hyperbilirubinemia. Serum bilirubin ≥ 12.9 mg/dl after 72 hours of life was taken as hyperbilirubinemia needing phototherapy and treatment is advised to all those full term healthy babies as per the American academy of pediatrics practice parameter. So in the present study babies with serum bilirubin level of ≥ 12.9 mg/dl are considered hyperbilirubinemia.

ANALYSIS AND RESULTS

Statistical analysis- Statistical data were analyzed with the independent sample t test and the descriptive analysis and chi-square tests. Sensitivity, specificity, negative and positive predictive value of the test was calculated.

The critical cord bilirubin level having the highest sensitivity and specificity was determined with the Receiver operating characteristics (ROC) curve analysis.

Cord serum bilirubin concentration was used for developing 'prediction test'. The sensitivity and specificity were calculated for predicting hyperbilirubinemia.

The present study infers that cord serum bilirubin level of babies with neonatal hyperbilirubinemia (≥ 12.9 mg/dl on 5th day) is significantly higher (mean-2.36 mg/dl) than without hyperbilirubinemia (mean-1.91 mg/dl). Out of 100 newborn 23 newborn had significant hyperbilirubinemia on 5th day (mean-15.16 mg/dl). Bilirubin profile of first 5 days of post natal life (table 1) infers that babies with neonatal hyperbilirubinemia has significantly higher bilirubin level compared to babies without hyperbilirubinemia.

Cord bilirubin level of ≥ 2.15 mg/dl cut off value is chosen based on the receiver operating characteristics (ROC) analysis.

In the present study cord serum bilirubin level of ≥ 2.15 mg/dl (table 2) has sensitivity & specificity both 65%, positive predictive value 65% and the negative predictive value of 64% in prediction of neonatal hyperbilirubinemia.

So the cord serum bilirubin level of >2.15 mg/dl can be used as an early predictor of neonatal hyperbilirubinemia ($p=0.004125$).

3rd day bilirubin level of ≥ 10.15 mg/dl cut off value is chosen based on the receiver operating characteristics (ROC) analysis. In the present study 3rd day serum bilirubin (table 3) level of ≥ 10.15 mg/dl has sensitivity 87%, specificity 80%, positive predictive value 86% and negative predictive value of 81%.

So the 3rd day serum bilirubin level of >10.15 mg/dl can also be used as an early predictor of neonatal hyperbilirubinemia (≥ 12.9 mg/dl).

DISCUSSION

In this study, study group is uniformly distributed with 53 male and 47 female babies. There is no significant correlation ($p 0.200$) in the serum bilirubin levels and the sex of the newborn. Hence the present study infers that the neonatal hyperbilirubinemia (≥ 12.9 mg/dl) is independent of the sex of the newborn.

In this study, the timing of initiation of breast feeding is significantly ($P=0.0183$) associated with neonatal hyperbilirubinemia. Early introduction have less chance of hyperbilirubinemia.

There is no significant association between the neonatal hyperbilirubinemia and maternal gestational hypertension with p value= 0.476 .

On ROC curve analysis critical cord bilirubin level (≥ 2.15 mg/dl) with high sensitivity and high specificity is selected. The probability that a neonate with cord bilirubin ≥ 2.15 mg/dl would later become hyperbilirubinemia (positive predictive value) was 65%. The negative predictive value, the probability of non-hyperbilirubinemia given a cord bilirubin lower than 2.15mg/dl was 64%. If a child become hyperbilirubinemic, the probability that the cord bilirubin was ≥ 2.15 mg/dl was 65% (sensitivity). Given a non-hyperbilirubinemic child, the probability that the cord bilirubin was <2.15 mg/dl was 65% (specificity). Present study showed significant correlation between cord blood bilirubin (>2.15 mg/dl) and neonatal hyperbilirubinemia (>12.9 mg/dl) on 5th day ($p = 0.0041$)¹⁸⁻²¹.

In this study, on ROC curve analysis critical 3rd day bilirubin level with high sensitivity and high specificity ≥ 10.15 mg/dl is selected. The probability that a neonate with 3rd day bilirubin higher than ≥ 10.5 mg/dl would later become hyperbilirubinemia (positive predictive value) was **86%**. The negative predictive value, the probability of non-hyperbilirubinemia given a 3rd day bilirubin lower than ≥ 10.15 mg/dl was **81%**. If a child become hyperbilirubinemic, the probability that the 3rd day bilirubin was ≥ 10.15 mg/dl was **87%** (sensitivity). Given a non-hyperbilirubinemic child, the probability that the 3rd day bilirubin was < 10.15 mg/dl was **80%** (specificity).

CONCLUSION

In the present study infants with neonatal hyperbilirubinemia had significantly higher levels of cord bilirubin. So it is possible to define a group of neonates at risk of developing jaundice needing phototherapy at birth. Simple knowledge of an increased risk of neonatal hyperbilirubinemia in a child could influence a decision of early discharge vs. prolonged observation.

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Conflict of Interest: None.

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Table 1: Bilirubin profile in first 5 postnatal days

	Neonatal hyperbilirubinemia (>12.9mg/dl)	N	Mean	SD	Std. Error Mean
Cord bilirubin	Yes	23	2.36	0.498	0.103
	No	77	1.91	0.708	0.080
3 rd day bilirubin	Yes	23	12.12	2.152	0.448
	No	77	8.51	2.018	0.230
5 th day bilirubin	Yes	23	15.16	2.016	0.420
	No	77	9.98	2.133	0.243

Table 2: Association between the neonatal hyperbilirubinemia (12.9mg/dl on 5th day) and critical cord bilirubin level (>2.15mg/dl)

Neonatal Hyper bilirubinemia (>12.9mg.dl)	Cord Blood Bilirubin (mg/dl)		Total
	>2.15	<2.15	
Absent	28	49	77
Present	14	9	23
Total	42	58	100

P= 0.004125 (P < 0.005, Significant)

Table 3: Association between the neonatal hyperbilirubinemia (>12.9mg/dl on 5th day) and critical 3rd day bilirubin level (>10.15mg/dl)

Neonatal Hyper bilirubinemia (>12.9mg.dl)	3rd day Blood Bilirubin (mg/dl)		Total
	>10.15	<10.15	
Absent	16	61	77
Present	20	03	23
Total	36	64	100