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Original Article

A Study of Cord Blood Albumin as a Predictor of Significant Neonatal Jaundice.

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Abstract

Background: Neonatal hyperbilirubinemia is the commonest abnormal physical finding during the first week of life and its early detection is essential for prevention of bilirubin encephalopathy. Early discharge of healthy term neonates is a common practice due to various reasons. The commonest cause for readmission of a normal neonate during early neonatal period is neonatal hyperbilirubinemia. Readmission causes considerable stress to the family members.
Aims: To assess whether cord blood albumin level could be used to predict the occurrence of significant jaundice requiring intervention.
Settings and Design: It is a prospective study undertaken in postnatal wards of a teaching hospital.
Material and Methods: Cord blood albumin was estimated in 130 healthy term neonates and they were divided into 3 groups based on cord blood albumin levels as follows: Group 1 with albumin levels <2.8g/dl; Group 2 with albumin levels between 2.8 and 3.3 g/dl and Group 3 with albumin levels of > 3.3g/dl. All the enrolled neonates were followed up for 72 hours and observed for clinical jaundice based on yellowish discoloration of skin. Neonates with evidence of clinical jaundice were subjected to total serum bilirubin estimation and hour specific values were plotted on Bhutani's charts.
Results: Clinical jaundice was present in 100 neonates for whom serum bilirubin estimation was done. There was a significant negative correlation between cord blood albumin levels and total serum bilirubin. Out of 100 neonates with clinical jaundice, 19 received phototherapy for significant hyperbilirubinemia. While all neonates in Group 1 received phototherapy none in Group 3 received intervention which was highly significant (p value <0.0001).
Conclusion: Cord blood albumin estimation helps in predicting the possibility of hyperbilirubinemia in healthy term neonates.

Key words: Cord blood albumin, Neonatal hyperbilirubinemia, Phototherapy

Introduction:

Neonatal Hyperbilirubinemia (NH) is the commonest abnormal physical finding during the first week of life. Over two third of newborn babies develop clinical jaundice.[1] Significant neonatal jaundice is often used to define any level of bilirubin requiring intervention in the form of phototherapy or exchange transfusion.[2] Jaundice in the newborn period is a medical emergency because unconjugated hyperbilirubinemia may cause bilirubin encephalopathy and its sequelae.[1] Early discharge of healthy term newborns after normal vaginal delivery has become a common practice because of medical reasons like prevention of nosocomial infections, economical constraints and social reasons.[3]American Academy of Pediatrics recommends that newborns who are discharged within 48 hours should have follow-up visits between 24 and 72 hours and again between 72 and 120 hours for development of any significant jaundice.[4] This recommendation may not be appropriate for our country due to limited follow-up in the community for various reasons. So, early prediction of jaundice will help in timely discharge and prevent re hospitalization of babies and mothers.

Unconjugated bilirubin is bound reversibly to serum albumin and when

bilirubin albumin complex reaches the liver, bilirubin is taken up by hepatocytes for conjugation and excretion. Albumin can bind bilirubin at a molar ratio of up to 1 or a maximum of up to 8.2 mg of bilirubin per gram of albumin. If serum albumin is low and binding of bilirubin is compromised there is a higher risk of bilirubin encepahalopathy.[5] There are reports of cord blood bilirubin as a predictor of significant neonatal jaundice.[3,6,7] There was paucity of literature on

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cord blood albumin as a predictor of significant jaundice when this study was started.[8]

Hence the present study was undertaken to find out the critical value of cord blood

albumin (CBA) in predicting subsequent development of significant neonatal jaundice in term normal neonates.

Materials and Methods :

The present study is a prospective study carried out over a period of one year from February 2012 to January 2013 in the postnatal wards of a teaching hospital in South India. The study cohort consisted of 130 randomly selected eligible term newborns. Systematic random sampling was done by collecting cord blood of every fifth (term gestation) baby delivered till the desired sample size was obtained. The study was approved by the Institutional Ethics Committee.

Term normal newborns delivered either by normal vaginal route or by caesarean section with birth weight ≥ 2.5kg and an APGAR Score ≥ 7/10 at 5 minutes were included in the study after obtaining consent from parents. Following were excluded from the study: preterm neonates, Rh incompatibility/ ABO incompatibility, sepsis, birth trauma, cephalhematoma, bruising/ ecchymosis, respiratory distress and those with major congenital anomalies.

Demographic profile and relevant information pertaining to the study was collected by using structured proforma, by interviewing the mother and also from mother's case sheet. At birth, 2 ml of cord blood sample was collected and analysed for albumin within 4-6 hours by dry chemistry auto analyzer Bromocresol

green method.[9] All enrolled babies were followed for 3 days and clinical assessment for jaundice was done according to Kramer dermal scale. In neonates with evidence of clinical jaundice, total serum bilirubin (TSB) was estimated by diazotized sulfanilic test.[10] Hour- specific values were plotted on Bhutani's chart and interventions were undertaken as per management guidelines.[4]

Categorical data was represented in the form of frequencies and proportions.

Chi-square was used as test of significance. Continuous data was represented as mean and standard deviation. Correlation was done to find the relationship between two quantitative variables. P value <0.05 was considered as statistically significant.

Results:

A total of 130 neonates were enrolled in the study. Baseline characteristics of the subjects are depicted in Table 1. They were divided into 3 groups based on cord blood albumin levels as Group 1(CBA level <2.8g/dl), Group 2 (CBA levels between 2.8 & 3.3 g/dl) and Group 3 (CBA levels >3.3 g/dl).

TSB was estimated only in 100 neonates having clinical evidence of jaundice.

Mean serum bilirubin levels in Groups 1, 2 and 3 were 14.67± 2.77, 12.56 ± 2.60.71 ± 2.12 respectively . This difference in mean serum bilirubin levels among different cord blood albumin groups was highly significant statistically as shown by ANOVA test i.e., TSB levels increased with a decrease in CBA levels – Table 2.

Significant hyperbilirubinemia requiring intervention (phototherapy) was present in 19 % of neonates with clinical jaundice (19/100). None of the neonates received intervention on day 1 of life. Four neonates and 15 neonates required intervention on day 2 and day 3 respectively. Mean Serum Bilirubin levels of neonates who received phototherapy on day 2 and day 3 were 11.67± 1.98 and 16.32 ±0.93 respectively.

All the neonates in Group 1(CBA < 2.8g/dl) had significant hyperbilirubinemia requiring phototherapy while none of the neonates in Group 3 (CBA >3.3/dl) required phototherapy - Table 3. This observation was highly significant statistically (Pearson Chi-Square 56.56; Df 2; p value <0.0001**).

Discussion:

The commonest cause for readmission of a normal neonate during early neonatal period is NH. Readmission causes considerable burden to the family members in terms of finance and stress. The objective of the present study was to assess whether cord blood albumin level could be used as a predictor of NH and thereby formulate a discharge plan for term healthy neonates.

In the present study, majority (54.6%) of the term neonates had CBA levels of >3.3g/dl and only 7.7% had CBA levels of < 2.8g/dl which is in conformity with the findings of studies conducted by Praveena et al and Meena et al.[11,12] However, in other studies[8,13,14] majority of neonates had CBA levels < 2.8 g/dl which is in disagreement with our findings and in another study [15] majority of neonates had CBA levels between 2.8 and 3.3 g/dl. The differences can be explained by the variations in sample size in various studies. Moreover, the source of cord blood is from the mothers' circulation which probably reflects the nutritional status of the mother.

TSB levels progressively increased with a decrease in CBA levels as shown by mean serum bilirubin of 14.67±2.77 in neonates with CBA levels of <2.8g/dl and 10.71±2.12 in neonates with CBA of > 3.3g/dl. The findings of the present study are in conformity with the findings of other studies. [8,14,16] Out of 100 neonates with clinical jaundice, only 19 had significant jaundice requiring intervention. It was further observed that none of the newborns in Group 3(CBA >3.3g/dl) received phototherapy. Out of 35 neonates in Group 2 (CBA level between 2.8 and 3.3 g/dl), 9(25.7%) received phototherapy while all the 10 (100%) neonates in Group 1 (CBA < 2.8 g/dl) received phototherapy. The observation was statistically significant with a tendency for neonates with low CBA levels developing significant NH requiring intervention. None of the neonates required exchange transfusion in our study. Sahu et al[8] observed that 70% (14/20) of neonates with significant NH had CBA < 2.8g/dl . Meena et al[12] also reported that 81.8% of neonates with CBA <2.8g/dl received phototherapy while only 2.4% in the group with CBA>3.3 g/dl received phototherapy. In their study, 1(9.1%) neonate who required exchange transfusion was in the group with

CBA <2.8g/dl. Similar results were reported by Chaudhury et al. [16]

Neonates have an immature liver function with a decrease in synthesis of all major proteins including albumin. Albumin plays a major role in binding and transport of unconjugated bilirubin. Deficiency of albumin results in accumulation of neurotoxic unbound or "free" bilirubin resulting in bilirubin encephalopathy.[2]

Table 1: Baseline characteristics of cases (n=130).

Characteristics	Frequency	Percentage
Gender: Male Female	 72 58	 55.4 44.6
Birth Weight: 2.5-3.0 Kg >3.0-3.5 Kg > 3.5 Kg	 90 31 9	 69.2 23.8 6.9
Mode of Delivery: Normal Caesarean Section	 57 73	 43.8 56.2
Parity: Primigravida Gravida 2 Gravida≥ 3	 53 58 19	 40 44 16
Cord albumin Level (CBA) : <2.8 g/dl – Group 1 2.8-3.3 g/dl – Group 2 >3.3 g/dl – Group 3	 10 49 71	 7.7 37.7 54.6
Evidence of clinical jaundice: Yes No	 100 30	 76.9 23.1

Table 2: Association between Cord Blood Albumin and Total Serum Bilirubin levels (n=100).

Cord Blood Albumin (g/dl)	N	Total Serum Bilirubin (mg/dl)	
		Mean	Std Deviation
<2.8	10	14.67	2.77
2.8-3.3	35	12.56	2.60
>3.3	55	10.71	2.12
Total	100	11.75	2.68

INNOVA					
	Sum of squares	df	Mean Square	F	Sig
Between groups	167.433	2	83.716	14.908	<0.0001**
Within groups	544.722	97	5.616		
Total	712.155	99			

Table 3: Association between Cord Blood Albumin levels and neonates receiving phototherapy (n=100).

		Phototherapy		Total
		No (%)	Yes (%)	
Cord Blood Albumin (g/dl)	<2.8	0(0)	10(100)	10
	2.8-3.33	26(74.3)	9(25.7)	35
	>3.3	55(100)	0(0)	55
Total		81	19	100

(Pearson Chi-Square Test: Value 56.56; df 2; p value <0.0001**)

Conclusion:

The present study suggests that CBA levels of<2.8 g/dl can help to identify those term newborns that are likely to require further evaluation and intervention. Term neonates with CBA levels of > 3.3 g/dl can be considered to be safer, with much lesser chances of developing significant NH. Thus, prediction of NH will have widespread implications especially in a rural setup where there are limited resources and fewer hospital beds.

Abbreviations used: CBA: Cord blood albumin; **TSB:** Total serum bilirubin; **NH:** Neonatal hyperbilirubinemia.

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