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Original Research Article

An Analytical Cross Sectional Study to Assess the Correlation Between Various Levels of Cord Blood Albumin & Serum Bilirubin at 48 Hours of Age in Term Healthy Newborns

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Abstract

Introduction: Neonatal hyperbilirubinemia is the most prevalent abnormal physical finding in newborns and the leading cause of neonatal morbidity. Early detection of at-risk infants may aid in the provision of preventative therapy and follow-up. We aimed to see if the level of albumin in the umbilical cord at delivery predicts the development of neonatal hyperbilirubinemia in term neonates 48 hours later.

Methods: The level of cord blood albumin was measured at birth, followed by the level of serum bilirubin on the third postnatal day (48 hrs of age). The neonates were separated into three groups based on cord blood albumin levels of 2.8 g/dl (group I), 2.8-3.4 g/dl (group II), and >3.4 g/dl (group III), with 68, 179, and 93 neonates in each group**.**At 48 hours of age, 39 newborns (59.4%) in group I, 16 in group II, and 6 newborns (10.3%) in group III had serum bilirubin levels above an intermediate high-risk zone in the Bhutani nomogram. At 48 hours of age, newborns with low cord albumin (2.8g/dl) had significantly higher bilirubin levels.

Conclusion: At 48 hours of life, neonates with cord blood albumin 2.8 gm/dl had a significant connection with the development of hyperbilirubinemia in the intermediate high-risk zone or higher, according to the Bhutani nomogram.

Keywords: albumin, bilirubin, newborns

Introduction

Jaundice in the neonatal period is a common finding during the first few days after birth. Approximately 3% of healthy newborns develop jaundice with a serum bilirubin level of 15 mg/dl or higher. Neonatal hyperbilirubinemia (NH) is a cause of concern for both pediatricians and parents. [1] The concept of prediction offers an attractive option to identify babies

at risk of developing NH in institutions where healthy newborns are discharged within 24e48 h of birth. Clinical examination is suggestive, but to have a diagnosis of significant jaundice, serum bilirubin estimation is necessary. If the newborns at risk of developing hyperbilirubinemia are identified at the time of delivery, then an appropriate plan of management can be advised for follow-up. Phototherapy can be started early in this group of babies more effectively. [2]

The term 'jaundice' is derived from the French word

jaune, meaning yellow. [3] Jaundice is yellowish discoloration of skin, sclera and mucus membranes due to elevated levels of bilirubin in blood. Neonatal jaundice is the commonest abnormal physical finding during the first week of life. More than two thirds of neonates develop clinical jaundice [4, 5]. It affects nearly 85% of term and most preterm infants [6]. It accounts for 46% of hospital admissions in children up to 2 months of age and up to 78% in the first week of life [7].

Neonatal jaundice is the most common reason for readmission of the baby in the early neonatal period which causes a financial as well as socio-economic burden on families in developing and underdeveloped countries. [8]

Hour-specific monitoring as used by developing countries is not applicable in most busy government settings. Under these circumstances, it is also not reliable to discharge full-term newborns examining only by visual assessment of hyperbilirubinemia by Kramer's rule applying cephalo-caudal progression of bilirubin and may also have observer variability. If newborns at risk of hyperbilirubinemia can be identified using reliable predictors, they can be timely treated and can be provided better follow-up care, band observing closely before discharge will further reduce morbidity and readmission rate in such newborns. [9]

Albumin helps in bilirubin clearance via increasing hepatic transportation. Low serum bilirubin may decrease the hepatic clearance and thus will increase significant hyperbilirubinemia. The lower Normal limit for serum albumin in term babies is 2.8gm/dl. The mean serum albumin level at term is 3.1gm/dl. Hence the normal range of Serum albumin at term is 3.1±3g./dl. [10]

The present study was conducted to find out the correlation between cord blood albumin and serum bilirubin at 48 hours of life and to study whether low serum cord albumin level at birth can be used as a predictor for the development of hyperbilirubinemia above the high intermediate risk zone (>75th percentile) in healthy newborns.[11,12,13].

Materials and Method:

The present analytical cross sectional study was conducted in the Department of Pediatrics, Darbhanga Medical College & Hospital, Darbhanga, Bihar, India, for 15 months.

Methodology

The minimum sample size of 340 was calculated using EpiInfo software by Kelsey method at a confidence limit of 80%, with an estimated prevalence of 15%, with a margin of error at 5%, eligible newborns were included consecutively whose parents gave consent to participate in the study over the study period. Approval was taken from the institutional ethics committee before conducting the study. Informed consent was obtained from the parents of the newborn for demographic profile and relevant information was collected in predesigned proforma. Cord blood was collected at birth and analyzed by auto analyzer method for Cord Serum Albumin level. Venous blood samples were collected from the baby at 48 hours of life. Serum bilirubin estimation is done within

12 hours of collection of a sample by Diazotized sulfanilic test. Gestational age was assessed using

Ballard score, SGA, AGA and LGA were defined using Fenton chart. Newborns were dived into 3 groups for data analysis according to their cord albumin levels (<2.8, 2.8-3.4, and >3.4 g/dl), and were analyzed to find out association with 3 risk zone according to Bhutani nomogram (Low-risk zone, low intermediate risk zone and High intermediate-risk zone and above). Bilirubin level at or above high intermediate risk zone (over 75th percentile cut-off value11.3mg/dl) at 48 hours of age was considered a cut-off value to find out the association with cord blood albumin level. [12-14.].

Results:

Newborns with higher birth weight had a significantly lesser incidence of low cord albumin (<2.8)*. Gestational age and gender of the study population did not have a significant association with low cord albumin. 20% newborn had cord albumin <2.8-52.6% recorded values between 2.8 to 3.4 and 93 (27.3%) recorded cord albumin >3.4 g/dl. Newborns with higher birth weight had a significantly lesser incidence of low cord albumin (<2.8)*. (Table 1)

Out of 340 newborns, 93 (27.3%) serum bilirubin levels were at the low-risk zone, 186 (54.7%) at the low intermediate risk zone, while 61 (18.0%) were at the high intermediate risk zone at 48 hours of age. 57.3% of newborns with cord albumin level <2.8 g/dl recorded serum bilirubin at or above high intermediate risk zone, while 29.4 were at low intermediate risk zone and 2 new-born were at low risk zone at 48 hours of age. (Table 2)

Table-1: Demographic profile of study population according to cord blood albumin at birth

		Cord blood albumin(g/dl)			**Total**	
		<2.8	2.8-3.4	>3.4		
Gender	Male	58 (28.5%)	118 (58.1%)	27 (13.3%)	203 (59.7%)	>0.05
	Female	23 (16.7%)	72 (52.5%)	42 (30.6%)	137 (40.2%)	
Birth Weight	2.5-3	30 (36.1%)	42 (50.6%)	11 (13.2%)	83 (24.4%)	<0.05*
	3.1-3.5	7 (3.9%)	162 (90.5%)	10 (5.5%)	179 (27.7%)	
	>3.5	(3%)	6 (7.6%)	70 (89.7%)	78 (22.9%)	
Gestational age	mean age	65	69	73	207 (60.8%)	>0.05
	37-40 weeks	1 (2.9%)	29 (85.2%)	4 (11.7%)	34 (10.0)	
	>40 weeks	16 (16.1%)	54 (54.5%)	29 (29.2%)	99 (29.1%)	
Newborns with higher birth weight had a significantly lesser incidence of low cord albumin(<2.8)* Gestation al age and gender were not associated with low cord albumin at birth.						

Table-2: Comparison of Cord blood albumin at birth and Total serum bilirubin at 48 hours of age

Cord blood albumin(g/dl)	serum bilirubin at 48 hours of age (mg/dl)				
	Low-risk zone	Low intermediate-risk zone	High intermediate-risk zone	total	
<2.8	9 (13.2%)	20 (29.4%)	39 (57.3%)*	68 (20.0%)	p <0.05*
2.8-3.4	6 (3.3%)	157 (87.7%)	16 (8.9%)	179 (52.6%)	
>3.4	78 (83.8%)	9 (9.6%)	6 (6.4%)	93 (27.3%)	
Total	93 (27.3%)	186 (54.7%)	61 (18.0%)	340	
[P=<0.0 5*] A significant number of newborns with cord albumin level <2.8 g/dl recorded serum bilirubin above high intermediate risk zone in Bhutani nomogram at 48 hours of age. # 83.9% sensitivity, 81.7% specificity, and PPV 84.1% for cord blood albumin <2.8g/dl to detect hyperbilirubinemia at high intermediate ate risk zone.					

Discussion:

In resource constrained countries where the patient to bed ratio is very high, early prediction of hyper bilirubinaemia will help in early discharge, prevent re-hospitalization and reduce duration of hospital stay of babies and mothers. [15,16]

So there is a constant need for a marker which can be reliably used to predict development of significant jaundice in a neonate. [17]

According to recent AAP guidelines, healthy term newborns should be discharged within 48 hours of birth [9]. Hence it is necessary to identify the newborns at risk of developing hyperbilirubinemia following an early discharge from the hospital to avoid readmissions and complications as bilirubin encephalopathy and long term complications [13]. Albumin has a role in the transport and clearance of bilirubin. Albumin acts as a carrier protein for the transport of bilirubin, which eventually helps in the transfer of bilirubin to the liver where conjugation occurs.

There are a few studies that predict Neonatal hyperbilirubinemia by estimating cord blood bilirubin levels but vary in opinion. In our study we found that a cut-off level of cord blood albumin of 2.8g/dl had 83.9% sensitivity, 81.7% specificity,

and PPV 84.1% for prediction of hyperbilirubinemia for high intermediate cut-off level with a p-value of <0.05 in term newborns, with NPV of 75% indicating its usefulness. [Table 2] Reshad M, Ravichander B et al[18] with the sample size of 175 terms and preterm newborn found that cord blood albumin level ≤ 2.8 g/dL is a sensitive limit, with good sensitivity and positive predictive value, in both term and preterm neonates and Cord blood albumin level ≥ 3.4 g/dL was found to be relatively safe for neonates.

Statistical significance was noted between cord albumin with development of significant hyperbilirubinemia (p-value <0.001). In a study by Trivedi et al. [19]. 205 newborns out of 605 developed neonatal hyperbilirubinemia with 58.35% (120/205) of the neonates with cord albumin level <2.8 g/dl developing

significant neonatal hyperbilirubinemia required intervention with statistical significance of P <0.05. A study by Meena KJ et al. [20] found that cord bilirubin level >2.5 mg/dl had a sensitivity of 77%, specificity of 98.6% with NPV of 96% which supports the results of the present study. Pahuja et al. [21]. also observed that the predictive value of cord albumin to detect neonatal hyperbilirubinemia was 75% with 61.3% sensitivity, and 76.8% specificity following the present study.[22]

Conclusion:

In summary, we have demonstrated the predictive usefulness and clinical value of cord blood albumin level of <2.8 g/dl. Cord blood albumin being a cost-effective marker, can be implemented in daily clinical practice for better management of newborns at risk of developing hyperbilirubinemia.

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