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Original Research Article

Umbilical Cord Blood Serum Albumin as an Early Predictor of Neonatal Hyperbilirubinemia in Healthy Full-Term Newborns

Bhadra Singh. B[1], Saluvendri Chandrakanth Reddy[2], Tummala Shilpa Reddy[3]

[1]Assistant Professor, Department of Pediatrics, MNR Medical College and Hospital, Sangareddy, Telangana, India

[2]Senior resident, Department of Pediatrics, MNR Medical College and Hospital, Sangareddy, Telangana, India

[3]Assistant professor, Department of Pediatrics, MNR Medical College and Hospital, Sangareddy, Telangana, India

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Corresponding author: Dr. Tummala Shilpa Reddy

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Abstract:

Introduction: Neonatal hyperbilirubinemia is one of the most significant factors in early neonatal re-admissions. In a growing nation like India, socioeconomic issues are one of the most frequent causes of early discharge and less readmissions. Cord blood serum albumin, and cord blood serum bilirubin, are essential in predicting neonatal hyperbilirubinemia. The present study was aimed to assess the cord blood serum albumin in the prediction of neonatal hyperbilirubinemia at tertiary care hospital, Sangareddy.

Material and Methods: A source of 120 full term healthy neonates with more than 2.5 kg birth weight and APGAR score above 7/10 at 1 minute were included. A two ml of cord blood was collected from the maternal side umbilical cord. The blood sample was utilized to analyse the total serum bilirubin and serum albumin.

Results: The levels of serum albumin were ≤2.8 g/dl in 45.83%, 2.9-3.33 g/dl in 33.33% and ≥3.4 g/dl in 20.83%. The diagnostic prediction of albumin levels in related to neonatal hyperbilirubinemia showed sensitivity, specificity, positive predictive value and negative predictive values for serum albumin level ≤2.8 g/dl was 93.1%, 88.8%, 59.7% and 98.5%, for 2.9-3.3 g/dl was 7.5%, 58.2%, 3.8% and 80.4% and for >3.3 g/dl was 0%, 61.2%, 0% and 81.8% respectively.

Conclusion: There was a significant correlation between healthy full-term infants with hyperbilirubinemia with low levels of cord blood serum albumin (2.8g/dl). Cord blood serum albumin is a sensitive marker for the diagnosis of neonatal hyperbilirubinemia.

Keywords: Serum albumin, Bilirubin, Neonatal Hyperbilirubinemia, Cord blood.

Introduction

Neonatal hyperbilirubinemia, which is seen in 84% of newborns, is a common reason for hospital readmission in neonates. Kernicterus is the result of severe hyperbilirubinemia, which is characterised by excess total blood bilirubin levels above 20 mg/dl [1, 2]. Early identification of newborns who run the risk of having substantial hyperbilirubinemia is essential for preventing negative consequences.

The American Academy of Paediatrics (AAP) advises that neonates who are released from the hospital within 48 hours should visit again in 48–72 hours to check for any serious jaundice or other issues [3]. In developing countries like India, due to the socioeconomic factors influence It has become crucial to have accurate predictors that allow medical professionals to ascertain whether prematurely released neonates are more likely to develop significant hyperbilirubinemia. Infants who are likely to develop hyperbilirubinemia can easily be readmitted if neonatal jaundice is detected early and can get simple and affordable phytotherapy treatment [4]. A number of research have been conducted to determine whether first day bilirubin levels, albumin, and cord bilirubin levels can be used as screening measures for later newborn hyperbilirubinemia [5-7].

Predictors including cord blood albumin, cord blood bilirubin, cord blood albumin/bilirubin ratio and alpha fetoprotein have been explored in neonatal hyperbilirubinemia [8]. In continue, we aimed to assess the cord blood serum albumin in the prediction of neonatal hyperbilirubinemia at tertiary care hospital, Sangareddy.

Materials and Methods

The present study was conducted in the Department of paediatrics, MNR Medical College and Hospital, Sangareddy during April 2022 to March 2023. A source of 120 full term healthy neonates delivered at MNR medical college and hospital were selected randomly. The full term new born with more than 2.5 kg birth weight and APGAR score above 7/10 at 1 minute were included. Newborns with neonatal sepsis, congenital anomalies, preterm births, respiratory distress, and existed with neonatal jaundice were excluded. Written informed consent was obtained from the parents and study protocol was approved by the institutional ethics committee.

Demographic and clinical history of participants including gestational age was collected from maternal case records. A 2 ml of cord blood was collected from the maternal side umbilical cord. The blood sample was utilized to analyse the total serum bilirubin and serum albumin. Data was extracted to Microsoft excel sheet and analysed by using SPSS version 23.0. Categorical variables were expressed in frequency and percentages. Continuous variables were presented in mean and standard deviation. Chi-square analysis was used to compare the study parameters and p<005 was considered as statistically significant.

Results

Table 1: Clinical history of study participants

Parameters	No of cases (n=120)	
	Frequency	Percentage
Gender		
Male	52	43.3%
Female	68	56.7%
Mode of delivery		
Vaginal delivery	85	70.83%
C-section	35	29.17%
Birth weight (In kg)		
2.2–3.0	79	65.83%
3-3.7	34	28.3%
>3.7	07	5.83%
Maternal weight (In kg)		
<50	02	1.67%
51-60	29	24.17%
61-70	54	45%
>70	35	29.67%
Intake of oxytocin		
Yes	94	78.33%
No	26	21.67%
Levels serum albumin (g/dl)		
≤2.8	55	45.83%
2.9-3.3	40	33.33%
≥3.4	25	20.83%
Total serum bilirubin (mg/dl)		
<10	16	13.3%
11-14	87	72.5%
15-17	10	8.33%
>17	07	5.83%

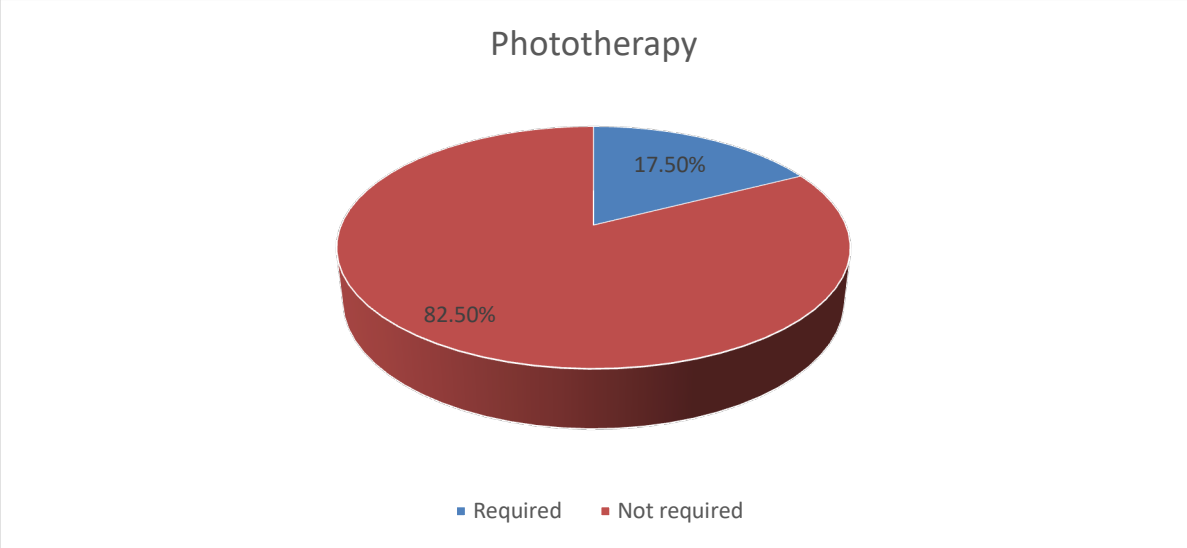

Figure 1: Details of phototherapy requirement among the participants

Table 2: Comparison of clinical parameters with serum albumin levels

Parameters	Serum albumin levels (g/dl)						p-value
	≤2.8 (n=55) (Group-A)		2.9-3.3 (n=40) (Group-B)		≥3.3 (n=25) (Group-C)		
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	
Gender							
Male	20	36.36%	20	50%	12	48%	1.388
Female	35	63.64%	20	50%	13	52%	
Birth weight (In kg)							
2.2–3.0	37	67.27%	25	62.5%	17	68%	0.827
3-3.6	15	27.27%	13	32.5%	06	24%	
≥3.7	03	5.46%	02	5%	02	8%	
Maternal weight (In kg)							
≤50	02	3.64%	-	-	-	-	1.422
51-60	12	21.82%	10	25%	07	28%	
61-70	28	50.91%	13	32.5%	13	52%	
>70	13	23.64%	17	42.5%	05	20%	

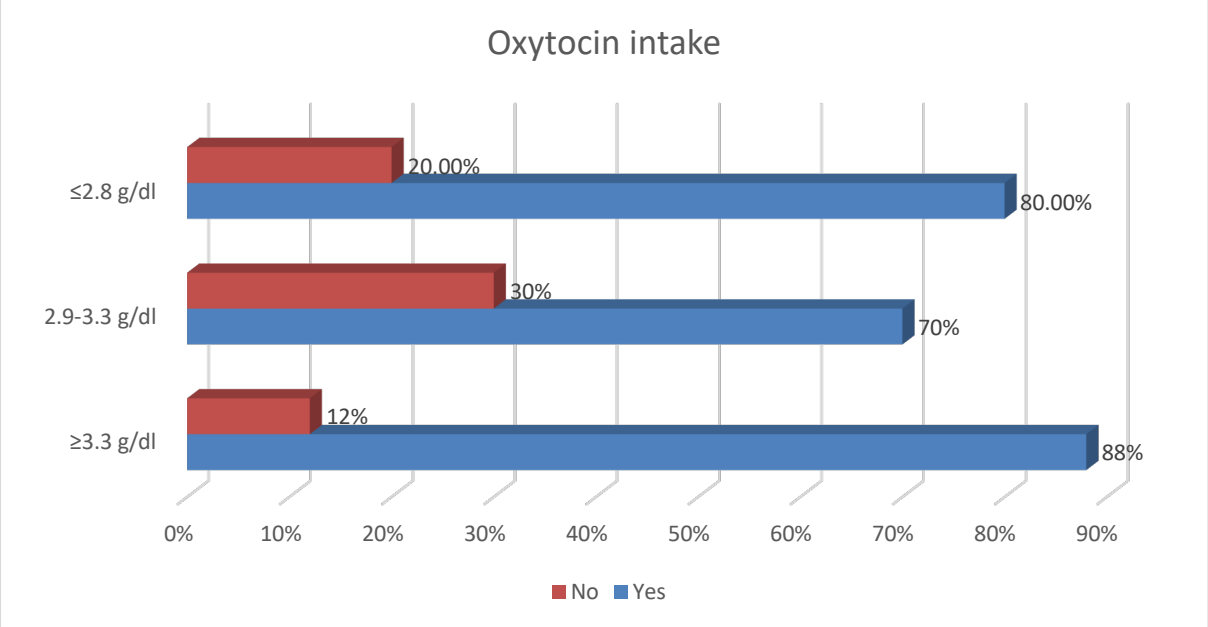

Figure 2: Comparison of oxytocin intake with different serum albumin levels

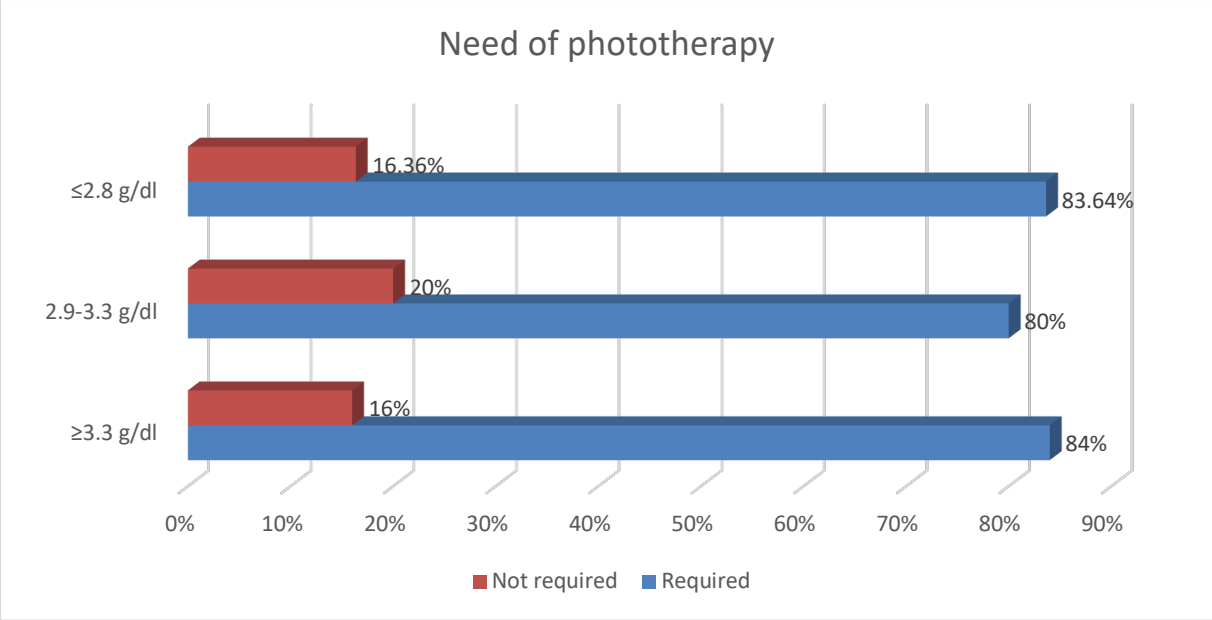

Figure 3: Comparison of phototherapy requirement with different serum albumin levels

Table 3: Diagnostic prediction of different cut off levels of cord blood albumin in the prediction of neonatal hyperbilirubinemia

Parameters	Serum albumin levels (g/dl)		
	≤2.8	**2.9-3.3**	**>3.3**
Sensitivity	93.1%	7.5%	0%
Specificity	88.8%	58.2%	61.2%
PPV	59.7%	3.8%	0%
NPV	98.5%	80.4%	81.8%

*PPV- Positive predictive value, NPV-Negative predictive value

Discussion

Majority of the neonates were females (56.7%) than male (43.3%). Vaginal delivery (70.83%) was a common mode of delivery followed by caesarean section delivery (29.17%). The birth weight was 2.2-3 kg in 65.83%, 3-3.7 kg in 28.3% and above 3.7 kgs in 5.83% of neonates. The maternal weight was 61-70 kg in 45%, followed by >70 kg (29.67%), 51-60 kg (24.17%) and less than 50 kg (1.67%). 78.33% of participants had oxytocin. The levels of serum albumin were ≤2.8 g/dl in 45.83%, 2.9-3.33 g/dl in 33.33% and ≥3.4 g/dl in 20.83%. The total serum bilirubin <10 mg/dl in 13.3%, 11-14 mg/dl in 72.5%, 15-17 mg/dl in 8.33% and above 17 mg/dl in 5.83% of neonates (Table 1). The need of phototherapy was seen 17.5% of neonates (Graph 1). In 100 healthy full-term neonates with ages ranging from 1 to 5 days, Aasam AI et al. discovered low cord blood albumin (2.8 g/dl) in 60% and normal cord blood albumin (2.8 g/dl) in 40% [9]. 170 neonates with a mean age of 37.9 weeks and a mean birth weight of 2.9 kg were included in a study by Khairy May Ahmed KM et al. Around 84% of newborns showed substantial hyperbilirubinemia, with a median cord blood albumin level of 2.8 g/dl in 67.9% of cases, 2.8–3.3 g/dl in 25%, and 3.3 g/dl or higher in 7% of cases [10]. On 50 newborns, George NA et al. discovered that 14% had serum bilirubin levels below 2.8 g/dl, 68% had levels between 2.8 and 3.3 g/dl, and 18% had levels above 3.3 g/dl [11]. Haridas K et al., included 500 healthy full-term neonates, in that 60.6% showed caesarean delivery and 39.4% showed vaginal delivery, 95% of neonates had birth weight between 2.5-3.5 Kg and 5% with both weight >3.5 kg [12]. Sharma Indra Kumar et al., included 388 neonates with mean birth weight of 2.836 kg, cord blood albumin at birth was 3.23 g/dl and cord blood bilirubin was 2.50 mg/dl [13].

The levels cord blood serum albumin was categorized in to three groups. Group A with albumin ≤2.8 g/dl, group B between 2.9-3.3 g/dl and group C has >3.3 g/dl. The comparison of serum albumin levels with clinical parameter exhibited that the females were more common in three groups of serums albumin levels. Neonates with birth weight between 2.2 -3 kgs were common in three groups (7.27%, 62.5% and 68% in group A, B & C respectively). The maternal weight was between 61-70 kg in majority participants of group A & C and above 70 years in group B. The intake

of Oxytocin was observed in 80% of group A, 70% of group B and 88% of group C. Majority neonates (83.64%, 80% & 84% in group A, B & C respectively) were required phototherapy in three levels of serum albumin.

There was a significant association between different serum albumin levels with intake of oxytocin and requirement of phototherapy ($p<0.05$). Sharma Indra Kumar et al., included 388 neonates, in that 26.03% had cord blood albumin levels <2.9 g/dl, 22.42% had between 2.9-3.29 g/dl and 51.54% had >3.3 g/dl [13]. Pabitra Sapkota et al., found cord blood albumin <2.9gm/dl in 20% of neonates, 2.9-3.5gm/dl in 47% and >3.5gm/dl in 33% of neonates. There was no significant association between different levels of bilirubin with gender, mode of delivery and birth weight ($p>0.05$) [14].

The diagnostic prediction of three albumin level groups with the prediction of neonatal hyperbilirubinemia showed sensitivity, specificity, positive predictive value and negative predictive values for serum albumin level ≤2.8 g/dl was 93.1%, 88.8%, 59.7% and 98.5%, for 2.9-3.3 g/dl was 7.5%, 58.2%, 3.8% and 80.4% and for >3.3 g/dl was 0%, 61.2%, 0% and 81.8% respectively (Table 3).

A study by Sharma Indra Kumar et al., found sensitivity, specificity, PPV for cord blood albumin was 40.8%, 34.8% and 48.41%, for cord blood bilirubin was 97.4%, 40.6% and 71.09% respectively [13]. Aiyappa GKC et al., reported that cord blood albumin in detecting neonatal hyperbilirubinemia has sensitivity, specificity, PPV, NPV and accuracy of 71.8%, 65.1%, 38.9%, 88.2% a and 67.3% respectively [15]. Ghada MEM et al., reported that the sensitivity and specificity of cord blood albumin was 64.3% and 81.8% (16). The findings of present study were similar to the above findings.

According to Aasam AI et al. [9], the levels of albumin in the cord blood are sensitive indicators of future neonatal jaundice in healthy term infants. All healthy term babies should have their cord serum albumin, albumin, and bilirubin/albumin ratio measured before birth in order to avoid the risky effects of hyperbilirubinemia, such as acute bilirubin encephalopathy [10]. According to George NA et al., cord blood albumin can be used to predict newborn hyperbilirubinemia in term healthy infants [11]. Sharma Indra Kumar et al., stated that cord blood bilirubin and cord blood albumin ratio is better indicator than cord blood albumin alone and cord blood bilirubin for prediction of neonatal hyperbilirubinemia [13]. Pabitra Sapkota et al. reported that cord blood albumin can be considered as a predictor of neonatal jaundice because neonates with high cord blood albumin had lower level of total serum bilirubin [14]. According to Aiyappa GKC et al., the level of albumin in the cord blood can be used to gauge and forecast whether a newborn would have hyperbilirubinemia. To monitor neonatal risk factors, it is essential to frequently evaluate the albumin of cord blood [15].

According to Ghada MEM et al., cord blood albumin can be used as a preliminary indicator to spot neonatal hyperbilirubinemia in newborns [16]. According to Sun G et al., the bilirubin levels in cord blood serum can be used to predict the development of jaundice in healthy term newborns. Infants at low or high risk for hyperbilirubinemia may be identified using cord blood serum bilirubin levels, reducing the need for an unnecessarily protracted hospital stay [17].

The results of the current investigation showed that a sensitive marker for the diagnosis of newborn hyperbilirubinemia is the cord blood serum albumin. However, the current study imitates a single-centric approach and uses a small sample size with only full-term, healthy newborns. To clarify the predictive values of albumin and the sensitivity of albumin, bilirubin, and the bilirubin/albumin ratio as a major predictor for neonatal hyperbilirubinemia, additional large-scale researches are necessary.

Conclusion

To prevent complications like kernicterus, estimation of cord blood albumin is crucial for the early diagnosis of neonatal hyperbilirubinemia. This study findings showed a significant correlation between healthy full-term infants with hyperbilirubinemia and low levels of cord blood serum albumin (2.8g/dl) and concluded that the cord blood serum albumin levels is a valuable biomarker in the prediction of neonatal hyperbilirubinemia that helps clinicians to decide the need of further intervention.

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