e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(1); 926-929

Original Research Article

Cord Blood Albumin Level as a Predictor of Neonatal Physiological Jaundice in Healthy Term Neonate

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Received: 25-10-2023 / Revised: 23-11-2023 / Accepted: 26-12-2023
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Conflict of interest: Nil

Abstract:

Background: In the first week of life, up to 60% of term and 80% of pre-term newborns experience neonatal jaundice, which is the most prevalent reason for readmission globally. The goal of the current study was to determine how well umbilical cord blood albumin levels predicted the development of neonatal jaundice in healthy term newborns. The present investigation is undertaken to determine value of cord blood albumin in predicting the eventual development of serious newborn jaundice.

Methods: This prospective study, which involved 100 healthy term infants, was carried out in DMCH, Laheriasarai, Bihar. At birth, the cord blood albumin level was estimated. All infants with clinically diagnosed jaundice between the age 72 hours and 96 hours had their total serum bilirubin estimated. Based on cord albumin levels of less than 2.8 g/dL, 2.8–3.3 g/dL, and greater than 3.3 g/dL, respectively, the neonates were split into three groups, A, B, and C. The primary findings of the research were deduced based on serum bilirubin levels ≥17 mg/dL, phototherapy requirements for newborns, and exchange transfusion.

Results: There were 21, 35, and 44 births in Groups A, B, and C, in that order. In Group A, 18 (85.7%) neonates had total bilirubin of >17 mg/dL, of which 16 (76.19%) required phototherapy and 2 (9.52%) needed exchange transfusion. In Group B, twelve (34.2%) of the twenty-three (65.7%) infants who experienced jaundice required phototherapy; no other neonate needed an exchange transfusion. Out of the 15 (34.09%) individuals in Group C, 1 (2.2%) required phototherapy for the development of jaundice, and none of them needed exchange transfusion ($p<0.001$).

Conclusion: Whereas cord blood albumin >3.3 g/dL is likely safe for early discharge, cord blood albumin ≤2.8 g/dL is a substantial risk factor for neonatal hyperbilirubinemia, which necessitates early management. Therefore, it is recommended to routinely measure the cord blood albumin level in order to monitor neonates who are at risk.

Keywords: Cord Blood Albumin, Hyperbilirubenemia, Neonatal Jaundice.

Introduction

Neonatal hyperbilirubinemia (NH) is the most common abnormal physical finding during the 1st week of life which affects roughly 60% of term and 80% of pre-term neonates. A normal new-born's serum bilirubin level is 6.1% higher than 12.9 mg%. Nearly 3% of normal term newborn have serum bilirubin over 15 mg% [1]. NH is the most frequent reason for readmission (6.5% of kids) in the early neonatal period, which is concerning to parents and pediatrician's alike [2].

Immature liver cells, low uridinediphosphoglucuronosyltransferase activity, low albumin content, and an increase in erythrocytes which have a shorter lifespan all contribute to physiological hyperbilirubinemia. The baby's reaction is expected given their limited capacity to eliminate bilirubin [3]. Albumin that is available for binding plays a crucial role in the transportation of unconjugated bilirubin to the liver, as it is non-polar and insoluble in water. An equimolar quantity of bilirubin is bound by one mole of albumin, meaning that one gram of albumin may bind 8.5 mg of bilirubin. It is generally believed that bilirubin coupled to albumin is non-toxic and does not enter the central nervous system.

Full-term newborns have fewer bilirubin binding sites because their plasma albumin levels are much lower than those of adults. Preterm newborns exhibit a more apparent paucity of binding sites due

to the inverse relationship between albumin level and gestational age. During the first few days following delivery, the level of plasma albumin rises quickly, with a typical increase occurring over the first seven days [4]. For a variety of reasons, early discharge following a typical vaginal birth healthy term newborns has become the norm in India. For all newborns who are released early during the first 48 hours of life, the AAP advises a follow-up visit after 48–72 hours [5]. The above guideline is not feasible due to the lack of follow-up facilities in our nation. This could create a delay in the diagnosis of jaundice, which could lead to bilirubin-induced brain damage and catastrophic side effects such cerebral palsy, sensorineural hearing, and intellectual disability[6,7]. Neonatal hyperbilirubinemia detection, follow-up, early treatment, and prevention of bilirubin-induced encephalopathy have become more challenging as a result of earlier discharge from the hospital.

Phototherapy is an easy, affordable, and successful way to cure jaundice early on. Furthermore, the exchange transfusion method of treating severe neonatal hyperbilirubinemia is expensive, fraught with risks, time-consuming, and labor-intensive. Due to the lack of neonatal critical care units in poor nations like India, the ultimate goal should be early detection and ensuring that babies benefit from early treatment protocols.

The idea of prediction presents a compelling choice for babies who are susceptible to NH. We can successfully create and conduct a follow-up program for neonates at risk of substantial neonatal hyperbilirubinemia by identifying these babies early in the birth process.

The goal of the current study was to determine whether cord blood albumin could be used to predict when severe newborn jaundice will manifest. This aids in determining whether to release the baby early in environments with limited resources.

Material and Methods

This is a hospital-based prospective study conducted at Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Bihar from June 2022 to May 2023 in 100 healthy eligible term newborns. Cord serum albumin level estimation was done at birth. At birth, 3 mL of cord blood was drawn and sent for cord blood albumin and TSH measurement. Using an automated analyzer, the biuret reaction technique was used to measure cord albumin. Up to the fourth day, babies were checked every day for the presence of icterus. Blood was submitted for total bilirubin calculation when icterus was detected, and the results were shown on the chart to determine the kind of intervention the infant needed. Three groups (A, B, and C) of neonates were created based on cord albumin levels: <2.8 g/dL, 2.8–3.3 g/dL, and >3.3 g/dL, respectively. The main result of the study was inferred in terms of NH serum bilirubin ≥17 mg/dL, required intervention, i.e., phototherapy and exchange transfusion. Term newborns, both genders, normal and LSCS modes of delivery, birth weights greater than 2.5 kg, a score of at least 7/10 at the 1st and 5th minutes of life, and normal cord blood TSH were among the inclusion criteria. Preterm birth, Rh incompatibility/ABO incompatibility, newborn infection, instrumental delivery (forceps and suction), hypoxia at birth, respiratory distress syndrome, amniotic fluid stained with meconium, and neonatal jaundice within 24 hours of birth were the exclusion criteria.

A Microsoft Excel sheet and the Statistical Package for the Social Sciences, version 21, were used to record all of the data. The means and standard deviation were used to summarize quantitative data, and percentages were used to summarize qualitative data. To determine the significance of the difference between proportions and percentages, the chi-square (X2) test was employed. The mean difference of several parameters was examined using Z-test and t-test. To determine whether there were any significant differences in the amounts of cord blood albumin across and within groups, analysis of variance was to be utilized. A difference that was deemed significant was $p<0.05$.

Results

In all, 100 newborns were included in our study. Group A contained 21 newborns, Group B contained 35, and Group C contained 44. In 18, 23, and 15 infants, jaundice was observed on the second, third, and fourth postnatal day, respectively. Groups A, B, and C had mean ages of 3.0±0.7, 3.0±0.7, and 4.0±0.5 days, respectively, at when jaundice first appeared. With the exception of delivery technique, Groups A, B, and C's gestational age, birth weight, and gender were similar (Table 1).

Table 1: Basic demographic characteristics of all three groups

Basic demographic characteristics	Group A (n=21) (Cord blood albumin<2.8 g/dl)	Group B (n=35) (Cord blood albumin 2.8-3.3 g/dl)	Group C (n=44) (Cord blood albumin >3.3 g/dl)	p-value
Gestational age (weeks)	38.1±0.7	37.9±0.8	37.8±0.7	>0.05
Birth weight (kg)	2.5±0.6	2.8±0.4	2.8±0.8	>0.05
Gender, n (%)				

• Male • Female	13(60%) 8(40%)	20(55%) 15(45%)	23(52%) 21(48%)	>0.05
Mode of delivery, n (%) • Cesarean section • Normal delivery	 10(47%) 11(52%)	 24(68%) 11(32%)	 13(30%) 31(70%)	 0.001

According to Table 1, there was no statistically significant correlation found between cord blood albumin and birth weight, sex of the newborn, or gestational age (p>0.05). The cord blood albumin of infants delivered vaginally and via cesarean section differed statistically significantly (p=0.001). The incidence of jaundice in all the groups and requirement for intervention in the form of phototherapy and exchange transfusion is illustrated in Table 2.

Table 2: Incidence of clinical jaundice and requirement of phototherapy or exchange transfusion in three groups

Incidence of clinical and requirement of interventions	Group A (n=21) (Cord blood albumin<2.8 g/dl)	Group B (n=35) (Cord blood albumin 2.8-3.3 g/dl)	Group C (n=44) (Cord blood albumin >3.3 g/dl)	p-value
Neonates developed clinical jaundice (Kramer≥3)	18(85.7%)	23(65.7%)	15(34.09%)	<0.001
Newborns requiring phototherapy	16(76.19%)	12(34.2%)	1(2.2%)	<0.001
Newborns requiring exchange transfusion	2(9.52%)	0	0	

Table 2 demonstrates that number of newborn who developed clinical jaundice required phototherapy and exchange transfusion in each three group is substantially diverse according to the cord blood albumin level (p<0.001).

Discussion

There is a risk of not diagnosing severe hyperbilirubinemia in time due to the rise in prematurely discharged neonates. As a screening method for the possibility of NH in the future, we evaluated the Cord serum albumin level in our investigation.

In our study, of 100 neonates, 85.7%, 65.7%, and 34.09% babies experienced jaundice in groups with cord blood albumin <2.5 g/dL, 2.5–3.3 g/dL, and >3.3 g/dL, respectively (p<0.001). Of Group A, 9.52% needed exchange transfusions and 76.19% needed phototherapy. Group B had 34.2% of participants requiring phototherapy, and no one needed exchange transfusion. In contrast, Group C had just 2.2% of participants requiring phototherapy, and no one needed exchange transfusion (p<0.001).

In our study, the majority of newborns experienced jaundice on the third postnatal day. In their research, other researchers also found that most newborns developed jaundice during the third and fourth postnatal days. According to Anand and Magotra's research, jaundice first appeared in 45.7% of newborns on the third postnatal day and in 35.3% of newborns on the fourth postnatal day [12]. According to Sethi et al., two-thirds of babies developed jaundice on the third postnatal day of life [13].

The current investigation suggests that the newborn's sex (>0.05) has no bearing on the NH (≥17 mg/dL). In a study including 200 neonates, Taksande et al. [14] and Rostami and Mehrabi [15] conducted in Iran discovered no association between the new-born's sex and the NH (≥17 mg/dL).

The relationship between the NH and the delivery method was examined in the current investigation. Babies delivered using LSCS were shown to have a higher incidence of neonatal hyperbilirubinemia (0.001). The manner of delivery and NH did not correlate, according to the Taksande et al. study [14] (p=0.527).

A few restrictions applied to our study: only healthy full-term neonates were included, and we only followed up on the rise in bilirubin for four days.

Conclusion

In healthy term neonates, umbilical cord serum albumin levels can be used to predict when substantial neonatal jaundice will develop later. Infants whose umbilical cord blood albumin level is greater than 3.3 g/dL can be safely released before their time, whereas those whose albumin level is less than 3.3 g/dL will require strict monitoring to prevent the onset of jaundice.

Therefore, we suggested that routine cord blood albumin quantification can be prioritized for all term neonates delivered in institutions. It will support the successful planning and execution of the follow-up program in high-risk groups as well as the early release of mothers and infants.

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