Predictive value of umbilical cord blood albumin levels as an indicator of neonatal jaundice in healthy term newborns

Prerna Bhat[1], S.R. Agarkhedkar[2], Shradha Salunke[3]

From [1]PG Resident, [2]Professor and HOD, [3]Associate Professor, Department of Paediatrics, Dr. D. Y. Patil Medical College and Hospital, Pune, Maharashtra, India

Correspondence to: Dr. Prerna Bhat, Department of Paediatrics, Dr. D.Y. Patil Medical College and Hospital, Dr D.Y. Patil Vidyapeeth, Pune - 411 018, Maharashtra, India.E-mail: prernabhat29@gmail.com

Received - 19 December 2019 Initial Review - 31 December 2019 Accepted - 24 January 2020

ABSTRACT

Background: Neonatal hyperbilirubinemia (NH) is the most common cause of readmission during the early neonatal period. There is a need to find the methods of screening babies at higher risk of developing jaundice before discharge. **Objectives:** The objectives of this study were to find out the predictive value of cord serum albumin (CSA) levels as an indicator of neonatal jaundice. **Materials and Methods:** A cross-sectional study conducted at a tertiary hospital of Maharashtra, from October 2017 to September 2019 on 410 term newborns. CSA was collected at birth and correlated with serum bilirubin levels collected at 48 h of life. Statistical analysis was performed and the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) with a 95% confidence interval obtained. **Results:** Of 410 cases, 266 (64.8%) developed clinical jaundice, of which 148 (93.6%) had albumin levels <2.8 g/dl, 79 (74.5%) between 2.8 and 3.3 g/dl, and 39 (26.7%) >3.3 g/dl. At CSA level <2.8 g/dl, the sensitivity of 93.67% with PPV and NPV of 51.57% and 94.65%, respectively, was found. At CSA level 2.8–3.3 g/dl, the sensitivity estimated was 85.98% with a PPV and NPV of 85.34% and 74.31%, respectively. **Conclusion:** In this study, CSA appears to be a risk indicator in predicting neonatal hyperbilirubinemia. CSA level <2.8 g/dl is a high-risk factor for the future development of neonatal hyperbilirubinemia, while those with CSA level >3.3 g/dl are probably safe for early discharge from the hospital.

Key words: *Cord serum albumin, Jaundice, Neonatal hyperbilirubinemia, Prediction*

The liver is the site of the synthesis of albumin. Human and animal fetuses can synthesize albumin endogenously from early fetal life, starting at approximately the 7th week of intrauterine life. It binds to unconjugated bilirubin and helps in the transport of bilirubin to the liver, where it is conjugated and then excreted in bile, in turn reducing its toxicity in the tissue. One gram of albumin roughly binds 8.5 mg of bilirubin [1]. Catabolism of 1 mol of hemoglobin produces 1 mol each of bilirubin and carbon monoxide and 1 g of hemoglobin produces 34 mg of bilirubin. Bilirubin being non-polar and insoluble in water is bound to serum albumin and transported to the liver. Bilirubin which is bound to albumin is non-toxic and cannot cross the central nervous system [1].

Clinical jaundice is seen in approximately 85% of term newborns and most of the preterm newborns. Total bilirubin (TB) >15 mg/dl is found in 3% of normal term infants and TB >12.9 mg/dl in almost 6.1% of the term newborns [2]. The increased incidence of jaundice is due to decreased uridine diphosphoglucuronyl transferase activity compared to adults [3], higher circulating erythrocyte volume, a shorter mean erythrocyte lifespan, and a larger early bilirubin peak [4]. Low production of albumin will lower bilirubin transport and increases the risk of kernicterus.

Kernicterus (chronic bilirubin encephalopathy) is associated with athetosis, athetoid cerebral palsy, partial or complete high-frequency sensorineural hearing loss, paralysis of upward gaze, dental dysplasia, and intellectual deficits [1]. Hence, the determination of at-risk neonates at an early stage and starting treatment can help avoid these complications. In such a situation, where there is a high birth rate, limited resources, economic burden, and increased risk of nosocomial infections to the newborn, finding methods to screen babies who are at higher risk of developing jaundice need attention. The present study was conducted to find out the predictive value of cord serum albumin (CSA) levels as an indicator of neonatal jaundice.

Table 1: Need for phototherapy at different CSA categories

Phototherapy	Albumin category (%)			
	<2.8	2.8–3.3	>3.3	Total
Yes	140 (88.60)	16 (15.09)	2 (1.25)	158 (38.5)
No	18 (11.39)	90 (84.91)	144 (98.6)	252 (61.4)
Total	158 (100)	106 (100)	146 (100)	410 (100)

CSA: Cord serum albumin

Table 2: Diagnostic predictability of different CSA levels

Variables	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	Kappa
CSA <2.8	93.67	56.01	51.57	94.65	68.57	0.4126
CSA 2.8–3.3	85.98	73.29	85.34	74.31	81.46	0.5945

CSA: Cord serum albumin, PPV: Positive predictive value, NPV: Negative predictive value

MATERIALS AND METHODS

A cross-sectional study, with a sample size of 410, was conducted at a tertiary hospital of Maharashtra, from October 2017 to September 2019, after getting the approval of the Institutional Ethical Committee. Healthy term neonates (>37 weeks) of both genders born by any mode of delivery (normal delivery and cesarean section) with any birth weight and Apgar score ≥7 at 1st and 5th min of life were included in the study. The neonates, who were born preterm, with birth asphyxia or neonatal jaundice within the first 24 h of life, ABO and Rh incompatibility or meconium-stained amniotic fluid, and respiratory distress, were excluded from the study.

After explaining the study and obtaining an informed written consent from the parents or caregivers, CSA was collected at birth. The newborns were followed up for clinical jaundice assessed by the Kramers scoring scale. Serum bilirubin levels were then collected at 48 h of life. Based on the CSA levels, the study was divided into three Groups A, B, and C: Group A included newborns with CSA levels <2.8 g/dl, Group B included newborns with CSA levels between 2.8 and 3.3 g/dl, and Group C included newborns with CSA levels >3.3 g/dl. After obtaining the data, it was plotted on various tables and graphs and then statistical analysis of the data was performed using the OPENEPI software to obtain the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV).

RESULTS

The study included 239 (58%) males and 171 (42%) females. Of total 410 neonates, 158 (38.5%) had CSA levels <2.8 g/dl, 106 (25.85%) had levels between 2.8 and 3.3 g/dl, and 146 (35.6%) had CSA levels >3.3 g/dl. Total 140 (88.6%), 16 (15.09%), and 2 (1.25%) neonates with CSA <2.8 g/dl, between 2.8 and 3.3 g/dl, and >3.3 g/dl required phototherapy, respectively (Table 1). CSA level <2.8 g/dl had a sensitivity of 93.67% with PPV and NPV of 51.57% and 94.65%, respectively. At CSA levels between 2.8 and 3.2 g/dl, the sensitivity was 85.98% with a PPV and NPV of 85.34% and 74.31%, respectively (Table 2). Figure 1 shows a linear relationship between cord serum albumin levels and serum bilirubin. As the albumin levels increase the serum bilirubin levels decrease.

DISCUSSION

India has a birth rate of roughly 20 births/1000 population [5]. With such a high birth rate and limited resources available in terms of economy, hospitals, doctors, and nursing staff, there is a lot of burden on the community. Neonatal hyperbilirubinemia

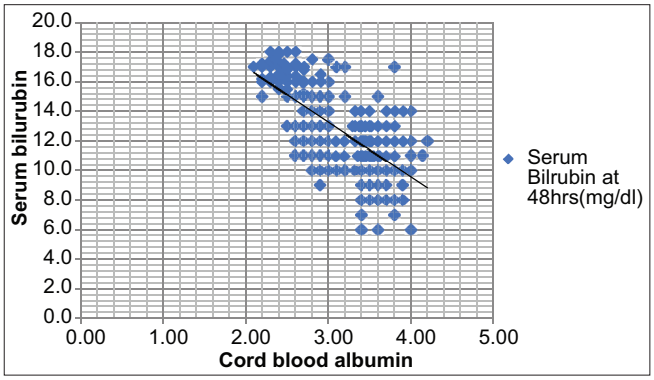

Figure 1: Scatter diagram showing the correlation between cord blood albumin and serum bilirubin at 48 h of life

(NH) is the most common cause for readmission to the NICU after discharge in the 1st week, and so a newborn is kept for a minimum of 3 days in the hospital post-delivery. NNH, if not treated by phototherapy/exchange transfusion, can lead to acute bilirubin encephalopathy. All infants, who survive this phase, develop chronic bilirubin encephalopathy [6].

We tried to find out the predictive value of CSA levels as an indicator of neonatal jaundice. Observations were similar to those reported in the studies by Sahu *et al.* [7] in 2011 and Trivedi *et al*. [8] in 2013, with a statistically significant association between CSA level of <2.8 g/dl and subsequent development of NH. Sahu *et al*. observed that 82% of the newborns with CSA levels <2.8 g/dl developed significant NH, 40% with CSA levels 2.8–3.3 g/dl, whereas none with CSA >3.3 g/dl developed significant NH [7]. Chaudhry *et al*. divided 90 full-term neonates into three groups based on their CSA levels and found that all neonates with CSA <3.3 g/dl developed jaundice; of them, 16.75% from Group I received phototherapy and 3% needed exchange transfusion [9]. In the present study, 88.6% of neonates of Group I required phototherapy.

In a similar study by Mishra and Naidu, none of the term newborns with CSA levels ≥3.4 g/dl developed NH. They concluded that term neonates with hyperbilirubinemia with a total serum bilirubin level ≥17 mg/dl had levels of CSA of ≤2.8 g/dl, and this could be used as a risk indicator to predict the development of NH [10]. Similar observations were also reported by El Mashad *et al*. [11]. These results were in accordance with the present study. The study had a few limitations. The study only included term newborns. Serum bilirubin was tested in all newborns at 48 h of life irrespective of the presence or absence of jaundice assessed by the Kramers scoring scale.

CONCLUSION

Newborns with CSA level <2.8 g/dl are at a higher risk for the development of hyperbilirubinemia, while those with

level >3.3 g/dl are probably safe for early discharge. Larger scale researches are required to establish the predictive value of cord blood albumin for an early prediction of significant hyperbilirubinemia.

REFERENCES

1. Cloherty JP, Eichenwald EC, Stark AR. Neonatal hyperbilirubinemia. In: Manual of Neonatal Care. 6th ed. Philadelphia, PA: Lippincot Williams and Amp, Wilkins, a Wolters Kluwer Business; 2010. p. 180-211.
2. Cloherty JP, Martin CR. Neonatal hyperbilirubinemia. In: Manual of Neonatal Care. 8th ed. Philadelphia, PA: Lippincott Williams and Amp, Wilkins; 2010. p. 299.
3. MacDonald MG, Mullet MD, Seshia MM. Avery's Neonatology: Pathophysiology and Management of the Newborn. 6th ed. Lippincott Williams and Wilkins; 2005. p. 773.
4. Sackett DL, Hayes RB, Guyatt GH. Clinical Epidemiology: A Basic Science For Clinical Medicine. 2nd ed. Boston: Little Brown; 1991.
5. Ministry of Health and Family Welfare. Statistics. Government of India. Crude Birth Rate India. Available from: http://www.DataGov.in.VisualizationEnginev3.0.
6. Cloherty JP, Stork AR, Eichenwald EC, Hansen AR. Neonatal Hyperbilirubinemia. Manual of Neonatal Care. 7th ed. Philadelphia, PA: Lippincott Willams and Wilkins; 2012. p. 304-39.
7. Sahu S, Abraham R, John J, Mathew A, George A. Cord blood albumin as a predictor of neonatal jaundice. Int J Biol Med Res 2011;2:436-8.
8. Trivedi DJ, Markande DM, Vidya BU, Bhat M, Hegde PR. Cord serum bilirubin and albumin in neonatal hyperbilirubinemia. Int J Int Sci Innov Technol Sec A 2013;2:39-42.
9. Chaudhry E, Naveed A, Rahim A, Chaudhry Z. Decreased cord blood albumin: A predictor of neonatal jaundice. J Islam Int Med Coll 2016;11:149-52.
10. Mishra AK, Sanyasi Naidu C. Association of cord serum albumin with neonatal hyperbilirubinemia among term appropriate-for-gestational-age neonates. Int J Pediatr Adolesc Med 2018;5:142-4.
11. El Mashad GM, El Sayed HM, El Shafie WA. Cord blood albumin-bilirubin as a predictor for neonatal hyperbilirubinemia. Menoufia Med J 2019;32:1071-7.

Funding: None; Conflicts of Interest: None Stated.

How to cite this article: Bhat P, Agarkhedkar SR, Salunke S. Predictive value of umbilical cord blood albumin levels as an indicator of neonatal jaundice in healthy term newborns. Indian J Child Health. 2020; 7(2):47-49.

Doi: 10.32677/IJCH.2020.v07.i02.001