International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Website: https://ijmpr.in/

Original Article

Study of Level of Cord Blood Albumin as A Predictor of Significant Hyperbilirubinemia in Term Neonates

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Received: 28-03-2026
Accepted: 16-04-2026
Published: 30-04-2026

ABSTRACT

Introduction: Neonatal hyperbilirubinemia, seen in 60% of term and 80% of preterm infants, is the most common clinical issue in the first week of life.It results from excessive bilirubin production, immature liver function, and enhanced enterohepatic circulation.
Aim: To study various levels of cord blood albumin as a predictor of significant hyperbilirubinemia in term neonates.
Methodology: This hospital-based observational study was a prospective study conducted over a period of 12 months, from November 2019 to October 2020. The research was carried out in the Inborn NICU of the Department of Pediatrics at S.P. Medical College and P.B.M. Associated Group of Hospitals, Bikaner, Rajasthan . The study population included term neonates delivered at PBM Hospital who met specific inclusion criteria.
Result: In our study, 26 out of 200 neonates (13%) required phototherapy, with a statistically significant association between lower cord serum albumin (CSA) levels and the need for intervention. The majority of cases with significant hyperbilirubinemia had CSA <2.5 gm/dl, and none required exchange transfusion. Mean serum bilirubin levels were highest in neonates with the lowest CSA. These findings align with previous studies, confirming CSA as a useful predictor of neonatal hyperbilirubinemia.
Conclusion: Cord serum albumin levels show a significant association with the development of neonatal hyperbilirubinemia in term neonates. A level below 2.5 gm/dl can serve as a reliable risk indicator. As a cost-effective tool, it can be safely integrated into routine neonatal screening to improve outcomes.

Keywords: *Cord, serum albumin, hyperbilirubinemia.*

INTRODUCTION

Neonatal hyperbilirubinemia, seen in 60% of term and 80% of preterm infants, is the most common clinical issue in the first week of life. It results from excessive bilirubin production, immature liver function, and enhanced enterohepatic circulation[1].Neonatal hyperbilirubinemia affects about 84% of newborns and is a leading cause of hospital readmission during the neonatal period. The AAP recommends that babies discharged within 2 days should have a follow-up visit within 48 to 72 hours[2,3]. Risk factors include bruising, prematurity, inadequate breastfeeding, hemolytic anemia, and a family history of jaundice. Early discharge is now common, benefiting families economically and emotionally, with studies showing higher maternal satisfaction and breastfeeding rates in early discharge groups[4,5].However, neonatal jaundice, the commonest cause for readmission of newborns to hospital goes unnoticed in those discharged early[6,7,8]. But such followup is not feasible in all cases in our country due to parental noncompliance andignorance.Kernicterus is an irreversible tragedy, which results in mortality and severe long-term morbidity. It comes under the 'Never Events' in the USA. Kernicterus is essentially preventable, as phototherapy has a definite risk reduction for bilirubin levels more than 20mg/dl.9Several risk factors contribute to significant neonatal hyperbilirubinemia requiring treatment, including blood group incompatibility, cephalhematoma, bruising, birth injuries, sibling history of jaundice, and high predischarge bilirubin levels. Despite advancements in understanding, accurately predicting which infants will develop severe hyperbilirubinemia remains

challenging. Hemoglobin breakdown produces one molecule each of carbon monoxide and bilirubin. Being non-polar and water-insoluble, bilirubin binds to serum albumin for transport to the liver. Albumin-bound bilirubin is typically non-toxic, while free bilirubin, which may circulate when albumin levels are low, can cross the blood-brain barrier and harm the brain. In term infants, physiological jaundice usually appears between 36–72 hours, peaks on day 4, resolves by day 10, and serum bilirubin rarely exceeds 15 mg/dL.In addition to hyperbilirubinemia, earlier gestational age, hemolysis, sepsis, and low birth weight are associated with the development of bilirubin encephalopathy, can be prevented if detected and treated early with simpletreatments like phototherapy[9].Low production of albumin will lower its transport and binding capacity and hence determination of at-risk neonates early will help to avoid the complications associated with neonatal jaundice[10,11].Hence it is important to determine the babies who are at risk of developing hyperbilirubinemia

AIM

To study various levels of cord blood albumin as a predictor of significant hyperbilirubinemia in term neonates

METHODOLOGY

This hospital-based observational study was a prospective study conducted over a period of 12 months, from November 2019 to October 2020. The research was carried out in the Inborn NICU of the Department of Pediatrics at S.P. Medical College and P.B.M. Associated Group of Hospitals, Bikaner, Rajasthan. The study population included term neonates delivered at PBM Hospital who met specific inclusion criteria, and in whom cord albumin levels were assessed. A random sampling technique was employed for participant selection. Inclusion criteria comprised term neonates delivered either by normal vaginal delivery or cesarean section, with a birth weight of ≥2.5 kg, APGAR score >7 at 5 minutes, and included both male and female infants. Exclusion criteria included preterm births, ABO or Rh incompatibility, neonatal sepsis, instrumental deliveries (forceps or vacuum), birth asphyxia, respiratory distress syndrome, meconium-stained amniotic fluid, cephalhematoma, and parents not willing to participate.

RESULT

Table 1. Gender wise distribution in study subject

Gender	No of cases	Percentage
Male	112	56.00%
Female	88	44.00%
Total	200	100.00

In present study, 56.00% newborn were male and 44.00% newborn were female.

Table 2. Anthropometry wise distribution in study subject

Anthropometry	Mean	SD
Head circumference(cm)	33.95	0.52
Length (cm)	49.59	0.36

In present study, mean head circumference was 33.95±0.52 mm. Mean length was 49.59±0.36 cm.

Table 3. Cord albumin wise distribution in study subject

Cord albumin level	No of cases	Percentage (%)
Group-I(<2.5 gm/dl)	15	7.50
Group-II(2.5 -2.8gm/dl)	22	11.00
Group-III2.9-3.2 gm/dl)	85	42.50
Group-IV(> 3.2 gm/dl)	78	39.00
Total	200	100.00

Among total subjects of study, maximum cases (42.50%) belonged to grouplll (cord albumin level between 2.9-3.2gm/dl) and minimum cases 7.50% belonged to group-l (cord albumin level below 2.5 gm/dl).

Table 4. Mean Cord Serum albumin in study subject

Cord albumin level	Mean	SD
(Gm/dl)	3.15	0.43

In present study serum albumin level was 3.15±0.43.

Table 5. Association between serum bilirubin and cord albumin level.

Serum bilirubin level (mg/dl)	Cord Albumin level (no. of cases) (gm/dl)				Total (no.of cases)
	<2.5	2.5-2.8	2.9-3.2	>3.2	
<10	0	4	6	28	38
10-14	0	8	73	41	122
15-16	1	5	3	5	14
≥17	14	5	3	4	26
Total	15	22	85	78	100.00

The above table shows that lower serum bilirubin level corresponded to higher albumin level and vice-versa. Newborns with serum bilirubin level <10mg/dl, maximum number of cases had serum albumin level >3.2gm/dl(28 cases) and those with 10-14mg/dl had maximum cases with S.Albumin (2.9-3.2gm/dl), and in subjects with cord serum albumin level <2.5gm/dl out of 15 cases, 14 neonates developed significant hyperbilirubinemia(>17mg/dl), thus association between S.bilirubin and cord serum albumin was found statistically Significant.

Table 6. Association between Cord albumin level and Significant hyperbilirubinemia.

Cord albumin level	Significant hyperbilirubinemia ≥ 17mg/dl		p-value
	Present	Absent	
Group-I(<2.5 gm/dl)	14 (93.33%)	1(6.64%)	
Group-II(2.5 -2.8gm/dl)	5(22.73%)	17(77.27%)	
Group-III2.9-3.2 gm/dl)	6(7.06%)	79(92.94%)	
Group-IV(> 3.2 gm/dl)	1(1.28%)	77(98.72%)	0.001
Total	26	174	200

In present study, the association between cord serum albumin and Significant hyperbilirubinemia was found to be statistically Significant. Out of 15 cases with cord albumin level less than 2.5 gm/dl, 14 cases developed significant hyperbilirubinemia.

Table 7. Correlation between Cord albumin and Mean total bilirubin.

Cord albumin level	Total serum bilirubin mg/dl		p-value
	Mean (mg/dl)	SD	
Group-I(<2.5 gm/dl)	17.85	0.17	
Group-II(2.5 -2.8gm/dl)	12.79	0.12	
Group-III2.9-3.2 gm/dl)	12.76	0.21	
Group-IV(> 3.2 gm/dl)	12.34	0.31	0.001

In present study, the correlation between cord serum albumin and Mean serum bilirubin level was found to be Statistically Significant.

Table 8. Association between phototherapy and Cord albumin level .

Phototherapy	Cord serum Albumin level (gm/dl)				Total(no. of cases)
	<2.5	2.5-2.8	2.9-3.2	>3.2	
No	1	17	79	77	74
Yes	14	5	6	1	26
Total (no. of cases)	15	22	85	78	100.00

The association between phototherapy and cord albumin was foundstatistically significant.

Table 9: outcome of study subjects

Outcome	**No. of cases(200)**	**Percentage (%)**
phototherapy	**26**	**13.00%**
Exchange transfusion	**0**	**0.00%**

In study subjects, 26 out of 200 received phototherapy (13%), whereas none required exchange transfusion.

DISCUSSION

Hyperbilirubinemia is a benign condition for infants born at term or near-term gestation. In around 5% of healthy term infants, however, serum bilirubin values exceeded 17 mg/dL (291 mmol/L), a value which the AAP deems significant.

In this study, we randomly selected subjects and observed that males were more than females i.e., 112 (56.00%) were male and 88 (44%) were female newborns with male female ratio 1.3:1, these results were comparable to the study done by Reshad et al[12] in which they included 39 males (52%) and 36 females (48%). The study done by Murali et al,[13] in 2014 showed 98 males (56%) and 76 females (44%) and the study done by Asit Kumar et al[14], had 169 males (56.3%) and 131females (43.7%).This shows that study subjects were male babies, predominantly.

Distribution of cases according to cord serum albumin as shown in table no 3, in our study show that in group I (<2.5gm/dl) comprised all 15 cases (7.5%) and group II (2.5-2.8gm/dl) constituted 22 cases(11%), group III (2.9-3.2gm/dl) had 85 cases (42.5%) and group IV(>3.2gm/dl) comprised 78 cases(39%), comparable to the results of study done by Usha et al,[15] group I(<2.8gm/dl) included 98 (54.4%) cases and group (2.9-3.3gm/dl) had 49 cases (27.3%) and group III(>3.3gm/dl) had 33 cases (18.3%). And in study cohort by Sannan et al[16] divided into groups based on cord albumin level measured at birth. Group I of 162 newborns, constituted 46.5% of the study cohort. Whereas Group II consisted of 106 newborns (30.5%) and Group III consisted of 80 new-borns (23%). Thus, in our study maximum cases (42.50%) belonged to group-lll (cord albumin level was 2.9-3.2 gm/dl) and minimum cases (7.50%) belonged to group-l (cord albumin level below 2.5 gm/dl). In our study Mean Cord Serum Albumin level was 3.15gm/dl±0.43, which was comparable to the study done by Zahoor Hussain et al[17] Mean Cord Serum Albumin level in Group-I was 2.58±0.12 and of group-II was 3.30±0.30 g/dl.

In table 5 Association between serum bilirubin level and cord albumin level we observed that lower serum bilirubin level corresponded to higher albumin level and vice-versa. Newborns with serum bilirubin level <10mg/dl, maximum number of cases had serum albumin level >3.2gm/dl (28 cases) and those with 1014mg/dl had maximum cases with S. Albumin (2.9-3.2mg/dl), and in subjects with cord serum albumin level <2.5gm/dl out of 15 cases, 14 neonates developedsignificant hyperbilirubinemia(>17mg/dl), thus association between s. bilirubin and cord serum albumin was found stastically Significant.

In present study, the association between cord albumin with significant hyperbilirubinemia as shown in table 6, we had 14 cases (93.3%) with CSA <2.5gm/dl, 5 cases (22.7%) had CSA 2.5-2.8gm/dl and 6 cases(7.06%)cases withCSA 2.9-3.2gm/dl and only one case (1.28%) with CSA level >3.2gm/dl developed Significant hyperbilirubinemia which was statistically significant (P=0.001) is comparable to the study by Sannan et al52 divided into Group I, Group II, Group III, based on Cord Serum Albumin (CSA) level ≤ 2.8g/dl, 2.9-3.3g/dl and ≥ 3.4g/dl respectively. In the study done by Reshad et al[12] of term newborn of 31 subjects ,19(61.2%) newborn with CSA < 2.8 g/dL developed neonatal hyperbilirubinemia. 13 (32.3%) newborns had CSA level between 2.9- 3.3 g/dL, and only 2 (6.5%) of the newborns with CSA level ≥3.4 g/dL developed significant neonatalhyperbilirubinemia. Thus, there was statistically significant relation of p value =0.001 in association between CSA and s. bilirubin in our study and also in accordance with the above studies Reshadetal, Sannan et al.[12,16]

In table 7 Correlation between Cord albumin and mean total bilirubin level in Group-I (<2.5 gm/dl) is 17.85mg/dl±0.17, Group-II (2.5 -2.8gm/dl) is 12.79mg/dl±0.12, Group-III (2.9-3.2 gm/dl) is 12.76mg/dl±0.21, Group-IV (> 3.2 gm/dl) is 12.34 mg/dl±0.31 respectively.

In present study Table 8. Association between phototherapy and Cord albumin level, Out of 26 cases,14 Cases with Cord serum albumin level less than 2.5 gm/dl and 5 cases with cord albumin level between 2.5-2.8mg/dl and 6 cases with CSA 2.9-3.2mg/dl and 1 case with CSA >3.2mg/dl had significanthyperbilirubinemia needed phototherapy which is in accordance to the study done by Usha et al[15], amongst 25 study subjects with CSA <2.8mg/dl, 20 cases underwent phototherapy and 5 cases with CSA 2.9-3.3 mg/dl was given PT.56 Study by Sannan et al,[16] out of 40 cases, group 1(CSA<2.8mg/dl) 38 cases, Group2(CSA<2.9-3.3mg/dl) 2 cases and Group 3(CSA>3.4 mg/dl) no cases developed NH requiring PT and in the study by Sahu et al,[18] out of 20 cases ,14 neonates, who had albumin levels less than 2.8 gm/dl developed hyperbilirubinemia requiring PT and about 2 cases needed exchange transfusion at higher levels of albumin that is 2.8 - 3.3 gm/dl 6 cases needed PT and with cord blood albumin > 3.3 gm/dl did not need any intervention for hyperbilirubinemia. The association between phototherapy and cord albumin was found statistically significant in our study.

The outcome of the study subjects in our study as shown in table 9, showed that 26 out of 200 received phototherapy (13%), whereas none of the cases required exchange transfusion as treatment for neonatal hyperbilirubinemia. this result is comparable to the study done by Usha et al, 5 cases who underwent exchange transfusion had albumin levels of less than 2.8gm/dl.[15] but in the study done by Sannan et al none of the cases required exchange transfusion[16].

CONCLUSION

There is a significant association between cord serum albumin values and the tendency to develop significant neonatal hyperbilirubinemia in term neonates and Cord serum albumin(<2.5gm/dl) taken in our study can be used as a risk indicator and to predict the development of significant hyperbilirubinemia.The evaluation of Cord serum Albumin being a cost-effective method, can be implemented safely in daily clinical practice, along with the presently available laboratory tests, for a better outcome in newborns developing hyperbilirubinemia

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