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Original Research Article

ASSESSING THE USEFULNESS OF CORD BLOOD ALBUMIN LEVEL AS A PREDICTOR OF NEONATAL PHYSIOLOGICAL JAUNDICE IN A HEALTHY TERM NEONATE

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ABSTRACT

Background: Neonatal jaundice is a commonly seen clinical condition globally, including in India seen in nearly 60% of subjects born at term and 80% of neonates born pre-term in their first week of life and is the most common cause of readmission in neonates. **Aim:** The present study aimed to assess the predictive value of umbilical cord blood albumin level for developing neonatal jaundice in healthy neonates born at term and the usefulness of cord blood albumin for predicting subsequent significant neonatal jaundice development.

Materials and Methods: The present study assessed 200 healthy term neonates where cord blood albumin level was estimated at birth. Estimation of total serum bilirubin was done for all the neonates at birth. Estimation of total serum bilirubin was done in all the neonates with clinically suspected jaundice at the age of 72-96 hours. The neonates were divided into three groups I, II, and III depending on cord albumin levels of <2.8g/dL, 2.8-3.3 g/dL, and >3.3 g/dL respectively. The main outcome assessed was concerning serum bilirubin ≥17 mg/dL, exchange transfusion, and the need for phototherapy.

Results: Groups I, II, and III had 42, 70, and 88 newborns respectively. In Group I, 85.7% (n=36) neonates had total bilirubin of >17 mg/dL, among which 76.19% (n=32) needed phototherapy, and 9.52% (n=4) subjects required exchange transfusion. In Group II. 65.7% (n=46) neonates developed jaundice whereas phototherapy was needed in 34.2% (n=24) neonates and no subjects needed exchange transfusion. In Group III, 34.09% (n=30) neonates developed jaundice here 2.2% (n=2) subjects needed phototherapy, and no subjects needed exchange transfusion which depicted a statistically significant difference with p<0.001.

Conclusion: The present study concludes that cord blood albumin level of ≤2.8g/dL is a significant risk factor for the development of neonatal hyperbilirubinemia that needs early intervention, whereas, cord blood albumin >3.3 g/dL is usually the safe criteria for early discharge.

Keywords: Albumin, Cord blood albumin, Hyperbilirubinemia, jaundice, Neonatal jaundice.

INTRODUCTION

NH or neonatal hyperbilirubinemia is the most common abnormal physical finding seen in 1st week of life of newborns and affects approximately 60% of term and 80% of neonates born at pre-term. Nearly 6.1% of newborns born normally depict serum bilirubin levels of >12.9 mg%.

Approximately 3% of term neonates have serum bilirubin >15 gm%. Neonatal hyperbilirubinemia is the major cause of worry for pediatricians and the parents and most common cause of readmission in neonates during the early neonatal period with nearly 6.5% affected babies.[1] Physiological hyperbilirubinemia results from immature liver cells, increased erythrocyte numbers having a short life span, low albumin concentration, and low diphospho-glucuronosyl-transferase activity. It is considered a normal body part response owing to limitations in the ability to excrete bilirubin.[2]

Unconjugated bilirubin is a non-polar molecule that is insoluble in water and transported to the liver in a bounded to-albumin state, hence, the albumin amount available for binding is vital. Bilirubin bound to albumin does not usually enter the central nervous system and is considered non-toxic. Full-term Newborn has lower plasma albumin levels which are significantly lower compared to adults and fewer binding sites to bilirubin. Albumin level is inversely proportional to gestational age; hence, the binding sites are more predominant in preterm infants. The level of plasma albumin rapidly increases in the first few days following birth leading to a mean increase in the first 7 days.[3]

Concerning the Indian context, owing to different reasons, early discharge is considered a common practice following normal vaginal deliveries and following LSCS (lower segment cesarean section) in healthy newborns at term. AAP (American Academy of Pediatrics) recommends recall visits in all newborns after 48-72 hours when subjects are discharged early in the first 48 hours of life. Owing to limited follow-up in India, AAP recommendations are not feasible leading to jaundice recognition delay which might lead to brain damage induced by bilirubin and serious consequences such as intellectual disability, sensorineural deafness, and/or cerebral palsy. It becomes more difficult to prevent bilirubin-induced encephalopathy, early treatment, follow-up, and recognition of neonatal hyperbilirubinemia owing to early discharge after birth.[4]

Early jaundice management with phototherapy is a cheap, simple, and effective protocol. Also, management of severe neonatal hyperbilirubinemia using exchange transfusion is a costly procedure associated with various complications needs skilled manpower, and has complications. Concerning developing nations such as India, owing to limitations in NICU (neonatal intensive care unit), the main aim must be early recognition and to ensure that newborns are maximally benefitted with early management protocol.[5]

The prediction concept depicts an attractive option to choose neonates at risk of neonatal hyperbilirubinemia. By prediction of newborns with a risk of significant neonatal hyperbilirubinemia presented early at birth, the study was designed. It implemented the follow-up program in these risk groups which is cost-effective.[6] The present study aimed to assess the usefulness of blood cord albumin for the prediction of subsequent significant neonatal hyperbilirubinemia development which might further help in deciding early discharge of newborns in resource-limited settings.

MATERIALS AND METHODS

The present prospective clinical study was aimed to assess the usefulness of blood cord albumin for prediction of subsequent significant neonatal hyperbilirubinemia development which might further help in deciding early discharge of newborns in resource-limited settings. The study subjects were from the Department of Pediatrics of the Institute. Verbal and written informed consent were taken from all the subjects before study participation.

The present study assessed 200 healthy-term neonates where cord blood albumin level was estimated at birth. Estimation of total serum bilirubin was done for all the neonates at birth. The inclusion criteria for the study subjects were term neonates from both genders, born by either LSCS or normal delivery, normal cord blood TSH (thyroid stimulating hormone), >7/10 at 1st and 5th min of life, birth weight >2.5kg, and where parents were willing to participate in the study. The exclusion criteria for the study were subjects with neonatal jaundice within 24 hours of life, meconium-stained amniotic fluid, respiratory distress syndrome, birth asphyxia, instrumental delivery (vacuum and forceps, neonatal sepsis, ABO incompatibility/Rh incompatibility, and pre-term infants.

After final inclusion, cord serum albumin levels we estimated in all the subjects at birth. At birth, 3ml of cord blood was collected and was sent for evaluation of TSH and cord blood albumin. Cord albumin was assessed utilizing the biuret reaction technique with the automated analyzer. Subjects were daily examined to assess the presence of icterus up to the 4th day. After detection of the presence of icterus, blood was sent for evaluation of total bilirubin, and the results were assessed for identification of the type of intervention needed in the babies included in the study.

The neonates from the study were divided into three groups I, II, and III depending on the cord albumin levels as <2.8 g/dL, 2.8-3.3 g/dL, and >3.3 g/dL respectively. The main outcome assessed in the present study was assessed in terms of neonatal hyperbilirubinemia of ≥17 mg/dL and newborns requiring intervention such as exchange transfusion and phototherapy.

The data gathered were analyzed statistically using SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk. NY, USA) for assessment of descriptive measures, Student t-test, ANOVA (analysis of variance), and Chi-square test. The results were expressed as mean and standard deviation and frequency and

percentages. The p-value of <0.05 was considered statistically significant.

RESULTS

The present prospective clinical study was aimed to assess the usefulness of blood cord albumin for prediction of subsequent significant neonatal hyperbilirubinemia development which might further help in deciding early discharge of newborns in resource-limited settings. The present study assessed 200 healthy-term neonates where cord blood albumin level was estimated at birth. Estimation of total serum bilirubin was done for all the neonates at birth. Among a total of 200 subjects assessed in the study, 42 neonates were from Group I, 70 subjects from Group II, and 88 subjects from Group III respectively. Jaundice was seen on the 2nd, 3rd, and 4th day post-natal in 36, 46, and 30 subjects from Groups I, II, and III respectively. The mean age of jaundice onset in Groups I, II, and III subjects was 3.2±0.5, 3.2±0.5, and 4.2±0.3 days respectively.

On assessing the demographic data in the study subjects, it was seen that the mean gestational age in Groups I, II, and III was 37.9±0.5, 37.7±0.6, and 37.6±0.5 weeks respectively with no statistical difference with p>0.05. Mean birth weight was 2.3±0.4, 2.6±0.2, and 2.6±0.6 kg in subjects from Groups I, II, and III respectively which was statistically non-significant with p>0.05. There were 60% (n=26), 55% (n=40), and 52% (n=46) males from Groups I, II, and III respectively, whereas, there were 40% (n=16), 45% (n=30), and 48% (n=42) females from Group I, II, and III respectively depicting statistically non-significant results with p>0.05. Normal delivery was done in 52% (n=22), 32% (n=22), and 70% (n=62) neonates from Groups I, II, and III respectively, whereas, cesarean delivery was done in 47% (n=20), 68% (n=48), and 30% (n=26) neonates respectively as seen in Table 1. [Table 1]

The study results showed that for assessment of clinical jaundice incidence and need for exchange transfusion or phototherapy in three study groups, newborns that developed jaundice as assessed with Kramer ≥3, 85.7% (n=36), 65.7% (n=46), and 34.09% (n=30) subjects from Groups I, II, and III respectively which was significantly higher in Group I with p<0.001. Newborns that needed phototherapy were 76.19% (n=32), 34.2% (n=24), and 2.2% (n=2) neonates from Groups I, II, and III respectively depicting statistically significant results with p<0.001. However, phototherapy was needed by only 9.52% (n=4) of subjects only from Group I. [Table 2]

Table 1: Demographic data of study subjects

S. No	Characteristics	Group I		Group II		Group III		p-value
		n	%	n	%	n	%	
1.	**Gestational age (weeks)**	37.9±0.5		37.7±0.6		37.6±0.5		>0.05
2.	**Birth weight (kg)**	2.3±0.4		2.6±0.2		2.6±0.6		>0.05
3.	**Delivery mode**							**0.001**
a)	Normal	22	52	22	32	62	70	
b)	Cesarean	20	47	48	68	26	30	
4.	**Gender**							>0.05
a)	Males	26	60	40	55	46	52	
b)	Females	16	40	30	45	42	48	

Table 2: Clinical jaundice incidence and need for exchange transfusion or phototherapy in three study groups

S. No	Clinical jaundice and intervention need	Group I		Group II		Group III		p-value
		n	%	n	%	n	%	
1.	**Newborns needing exchange transfusion**	4	9.52	0	0	0	0	-
2.	**Newborns needing phototherapy**	32	76.19	24	34.2	2	2.2	**<0.001**
3.	**Newborns developed clinical jaundice (Kramer ≥3)**	36	85.7	46	65.7	30	34.09	**<0.001**

DISCUSSION

The present study assessed 200 healthy-term neonates where cord blood albumin level was estimated at birth. Estimation of total serum bilirubin was done for all the neonates at birth. Among a total of 200 subjects assessed in the study, 42 neonates were from Group I, 70 subjects from Group II, and 88 subjects from Group III respectively. Jaundice was seen on the 2nd, 3rd, and 4th day post-natal in 36, 46, and 30 subjects from Groups I, II, and III respectively. The mean age of jaundice onset in Groups I, II, and III subjects was 3.2±0.5, 3.2±0.5, and 4.2±0.3 days respectively. These data were comparable to the previous studies of Rostami N et al7 in 2005 and Taksande A et al8 in 2005 where anthropometric data of study subjects from authors were comparable in neonates as in the present study.

The study results showed that on assessing the demographic data in the study subjects, it was seen that mean gestational age in Groups I, II, and III was 37.9±0.5, 37.7±0.6, and 37.6±0.5 weeks respectively with no statistical difference with p>0.05. Mean birth weight was 2.3±0.4, 2.6±0.2, and 2.6±0.6 kg in subjects from Groups I, II, and III

respectively which was statistically non-significant with p>0.05. There were 60% (n=26), 55% (n=40), and 52% (n=46) males from Groups I, II, and III respectively, whereas, there were 40% (n=16), 45% (n=30), and 48% (n=42) females from Group I, II, and III respectively depicting statistically non-significant results with p>0.05. Normal delivery was done in 52% (n=22), 32% (n=22), and 70% (n=62) neonates from Groups I, II, and III respectively, whereas, cesarean delivery was done in 47% (n=20), 68% (n=48), and 30% (n=26) neonates respectively. These results were consistent with the findings of Sayed MKG et al9 in 2020 and Aiyappa G et al10 in 2017 where authors assessed subjects with demographic data comparable to the present study.

It was seen that for assessment of clinical jaundice incidence and need of exchange transfusion or phototherapy in three study groups, newborns that developed jaundice as assessed with Kramer ≥3, 85.7% (n=36), 65.7% (n=46), and 34.09% (n=30) subjects from Groups I, II, and III respectively which was significantly higher in Group I with p<0.001. Newborns that needed phototherapy were 76.19% (n=32), 34.2% (n=24), and 2.2% (n=2) neonates from Groups I, II, and III respectively depicting statistically significant results with p<0.001. However, phototherapy was needed by only 9.52% (n=4) of subjects from Group I. These findings were in agreement with the results of Trived DJ et al11 in 2013 and Sahu S et al12 in 2013 where clinical jaundice incidence and the need for exchange transfusion or phototherapy similar to the present study was reported by the authors in their respective studies.

CONCLUSION

Within its limitations, the present study concludes that cord blood albumin level of ≤2.8g/dL is a significant risk factor for the development of neonatal hyperbilirubinemia that needs early intervention, whereas, cord blood albumin >3.3 g/dL is usually the safe criteria for early discharge. Hence, it can be helpful in the identification of neonates at risk. Hence, routine and regular determination of cord blood albumin levels can be utilized to note neonates at risk.

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