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UTILITY OF CORD SERUM ALBUMIN (CSA) IN PREDICTION OF NEONATAL HYPERBILIRUBINEMIA

DR. NAINI PURI[1], DR RAGINI SINGH[2], DR FARAH EHSAAN[3]

[1]Junior resident, Department of Pediatrics, Shri Guru Ram Rai Institute of Medical & Health Sciences, Patel Nagar, Dehradun
[2]Professor, Department of Pediatrics, Shri Guru Ram Rai Institute of Medical & Health Sciences, Patel Nagar, Dehradun
[3]Consultant, Department of Biochemistry, Shri Guru Ram Rai Institute of Medical & Health Sciences, Patel Nagar, Dehradun

Abstract

Background: Neonatal hyperbilirubinemia, characterized by elevated levels of bilirubin in the blood, is a common condition in newborns. Early identification of newborns at risk for severe hyperbilirubinemia is crucial for timely intervention and prevention of adverse outcomes. This study aims to investigate the utility of cord serum albumin (CSA) as a predictive indicator for neonatal hyperbilirubinemia in healthy term newborns.

Methods: This cross-sectional study was conducted at Sri Guru Ram Rai University of Medical and Health Sciences, Dehradun, Uttarakhand, from July 2021 to October 2022. The study sample included 248 term neonates with a gestational age of 37 weeks or more. The newborns were monitored for the development of jaundice, sepsis, or other ailments. Cord serum albumin of all healthy newborn was sent at birth and subsequent serum bilirubin levels were measured of newborns who were clinically icteric with Kramer stage equal to or > 3 to assess the presence and severity of hyperbilirubinemia.

Results: The study findings revealed a significant association between cord serum albumin levels and the development of neonatal hyperbilirubinemia. Newborns in Group A (<2.8 gm/dl) had a higher incidence of hyperbilirubinemia compared to Group C (>3.3 gm/dl). These findings suggest that lower cord serum albumin levels are associated with an increased risk of neonatal hyperbilirubinemia.

Conclusion: Cord serum albumin levels can serve as a useful predictor of neonatal hyperbilirubinemia in healthy term newborns. Identification of newborns with lower cord serum albumin levels can help healthcare providers implement appropriate preventive measures and interventions to reduce the risk of severe hyperbilirubinemia.

Keywords - neonatal jaundice, hyperbilirubinemia, cord serum albumin, predictive indicator, newborns, early identification, monitoring, bilirubin levels, cross-sectional study

1. Introduction

Neonatal jaundice, also known as icterus neonatorum, is a common condition observed in newborns during the first week of their lives. It affects approximately 85% of term infants and a majority of preterm neonates. Hyperbilirubinemia, defined as elevated bilirubin levels in the blood, is a significant concern associated with neonatal jaundice. In some cases, hyperbilirubinemia can lead to severe complications, including brain damage. Early identification and management of neonates at risk of developing hyperbilirubinemia are crucial for ensuring their well-being [1].

Currently, early discharge of healthy term newborns is a common practice due to various factors such as preventing nosocomial infections, social considerations, and financial

constraints. However, this practice often results in limited follow-up and monitoring, leading to potential delays in identifying and treating significant neonatal jaundice [2].

Cord serum albumin (CSA) has emerged as a potential biomarker for predicting neonatal hyperbilirubinemia. Albumin, the main protein binding bilirubin, plays a critical role in its transport and metabolism [3]. Lower levels of CSA in cord blood may indicate a higher risk of subsequent hyperbilirubinemia in newborns. By measuring CSA levels at birth, healthcare professionals may be able to identify infants at increased risk and initiate early interventions and targeted monitoring strategies [4].

This study aims to investigate the utility of CSA in predicting neonatal hyperbilirubinemia. We hypothesize that the level of albumin in cord serum can serve as a predictive indicator for the development of jaundice in healthy term newborns. By studying CSA levels and their correlation with neonatal hyperbilirubinemia, we aim to provide valuable insights into the potential clinical application of CSA as a predictive tool [5].

The identification of at-risk neonates or those with low CSA levels early on can help prevent complications and long-term sequelae associated with neonatal jaundice. Furthermore, it can facilitate early initiation of treatment, reducing the risk of bilirubin-induced brain damage [6].

In this article, we will explore the current understanding of neonatal hyperbilirubinemia and the associated risks. We will review existing literature on the predictive value of CSA in neonatal hyperbilirubinemia, analyzing studies that have examined the correlation between CSA levels and the development of jaundice. By critically evaluating the available evidence, we aim to contribute to the ongoing research in this field and shed light on the potential clinical implications of CSA in predicting neonatal hyperbilirubinemia.

2. Materials and Methods

Study Design: A hospital-based cross-sectional study

Study Area: Sri Guru Ram Rai University of Medical and Health Sciences, Dehradun, Uttarakhand

Study Duration: July 2021 to October 2022

Study Sample: 248 term neonates with gestational age ≥37 weeks

Inclusion Criteria

1. Term neonates with gestational age ≥37 weeks
2. Born by any mode of delivery
3. Both genders
4. APGAR score >7 at 1 minute of life

Exclusion Criteria

1. Gestational age below 37 weeks
2. Neonates with birth weight <2.5 kg
3. ABO or Rh incompatibility
4. Cephalhematoma and/or significant bruising
5. History of siblings with neonatal jaundice
6. Neonates developing any form of systemic infection
7. Infant of diabetic mother
8. Birth asphyxia (according to APGAR score)

Study Tools: Patient Proforma

Data Collection: All patients underwent routine clinical and pathological examinations. A detailed patient history was recorded using a standardized proforma. Two milliliters of cord blood were collected at birth for analysis of blood type and serum albumin levels using the BCG (bromocresol green colorimetric) auto analyzer method. The newborns were divided into three groups based on cord serum albumin levels: Group A (<2.8 gm/dl), Group B (2.8-

3.3 gm/dl), and Group C (>3.3 gm/dl). The newborns were monitored daily for the development of jaundice, sepsis, or other ailments until the fourth day of life or their discharge from the hospital. Serum bilirubin levels were measured for newborns suspected to have jaundice in zone 3 according to the Kramer dermal chart. Additional blood investigations were performed as needed [7].

Ethical Clearance: The study was conducted in accordance with the approved ethical standards of Sri Guru Ram Rai University of Medical and Health Sciences, Dehradun, Uttarakhand.

Statistical Analysis: Data was analyzed using Statistical Package for Social Sciences (SPSS) version 23. Categorical data were summarized as proportions and percentages, while quantitative data were summarized as mean (SD), median, or mode. Chi-square and other appropriate tests were used to check associations, with a p-value <0.05 considered statistically significant.

3. Results

Prevalence of Hyperbilirubinemia

Among the total 248 newborns included in the study, 171 (69%) were observed to have hyperbilirubinemia, while 77 (31%) were classified as normal.

Maternal Age

The mean maternal age was 27.54 years, ranging from 21 to 37 years, with a standard deviation of 2.943. This indicates that the study population consisted of mothers in their late twenties on average.

Gestational Age

The mean gestational age of the newborns was 38.17 weeks, with a range of 38 to 41 weeks. The standard deviation was 1.230, suggesting that the majority of the newborns in the study were delivered at term.

Birth Weight

The mean birth weight of the newborns was 2.83 kg, ranging from 2.50 kg to 3.40 kg. The standard deviation was 0.313, indicating a relatively narrow range of birth weights in the study population.

Kramer Staging

The mean Kramer staging was 3.10, ranging from 1 to 5, with a standard deviation of 1.162.
This staging system is used to assess the severity of jaundice in newborns, and the results suggest a moderate level of jaundice in the study population.

Cord Serum Albumin

The mean cord serum albumin level was 2.85 mg/dl, with a range of 1.4 to 6.0 mg/dl. The standard deviation was 0.964, indicating some variability in the albumin levels among the newborns. The lower levels of cord serum albumin were found to be significantly associated with the presence of hyperbilirubinemia ($p < 0.001$).

Additionally, various independent t-tests were conducted to examine the relationship between hyperbilirubinemia and different variables. The results showed that the Day of Life at which the newborns developed jaundice, Kramer Staging, cord serum albumin level, and maternal age were all significantly associated with hyperbilirubinemia ($p < 0.001$). However, there was no significant association observed between hyperbilirubinemia and variables such as gestational age, birth weight, and Apgar scores at 1 and 5 minutes.

The study also included a Receiver Operating Characteristic (ROC) curve analysis to determine the cutoff value of cord serum albumin for predicting hyperbilirubinemia. The area under the curve was 1.000, indicating a perfect predictive ability. The cutoff value of cord serum albumin to predict hyperbilirubinemia was determined to be 2.85 mg/dl, with a

sensitivity of 90.6%, specificity of 100%, positive predictive value of 100%, negative predictive value of 82.8%, and overall accuracy of 93.6%.

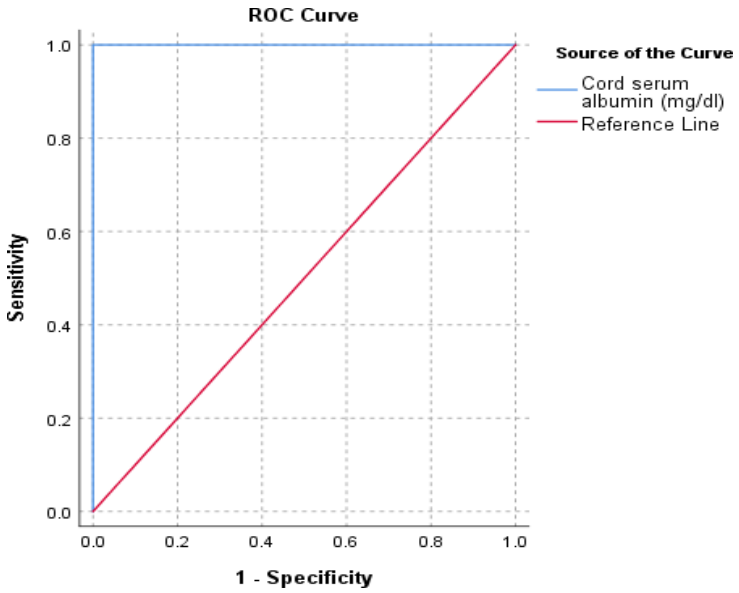
Furthermore, the study examined the association between hyperbilirubinemia and factors such as mode of delivery and sex of the baby. The results showed no significant difference in the prevalence of hyperbilirubinemia based on mode of delivery (vaginal delivery vs. cesarean section) or the sex of the baby (male vs. female).

In summary, the study found a high prevalence of hyperbilirubinemia among newborns, with lower levels of cord serum albumin being significantly associated with its presence. Other factors such as the Day of Life at which jaundice developed, Kramer staging, and maternal age were also found to be associated with hyperbilirubinemia. These findings contribute to our understanding of the risk factors and characteristics of neonatal hyperbilirubinemia.

Table 1 - Summarizing the key observations and results from the study

Variables	Total	Minimum	Maximum	Mean	Std. Deviation
Maternal Age (Years)	248	21	37	27.54	2.943
Gestational Age (weeks)	248	38	41	38.17	1.230
Birth Weight (kg)	247	2.50	3.40	2.83	0.313
Kramer Staging	248	1	5	3.10	1.162
Cord Serum Albumin (mg/dl)	248	1.4	6.0	2.85	0.964
Apgar Score at 1 Min	248	7	7	7.00	0
Apgar Score at 5 Min	248	8	8	8.00	0
Serum Bilirubin (mg/dl)	180	2.9	24.7	15.73	2.435

Figure 1 - ROC Curve



Dependent Variable: Hyperbilirubinemia Predictor: Cord serum albumin (mg/dl)

Cut-off of Cord serum albumin (mg/dl) to predict Hyperbilirubinemia is 2.85.

Table 2 – Cord serum albumin levels

CSA	Hyperbilirubinemia		Total
	Yes	No	

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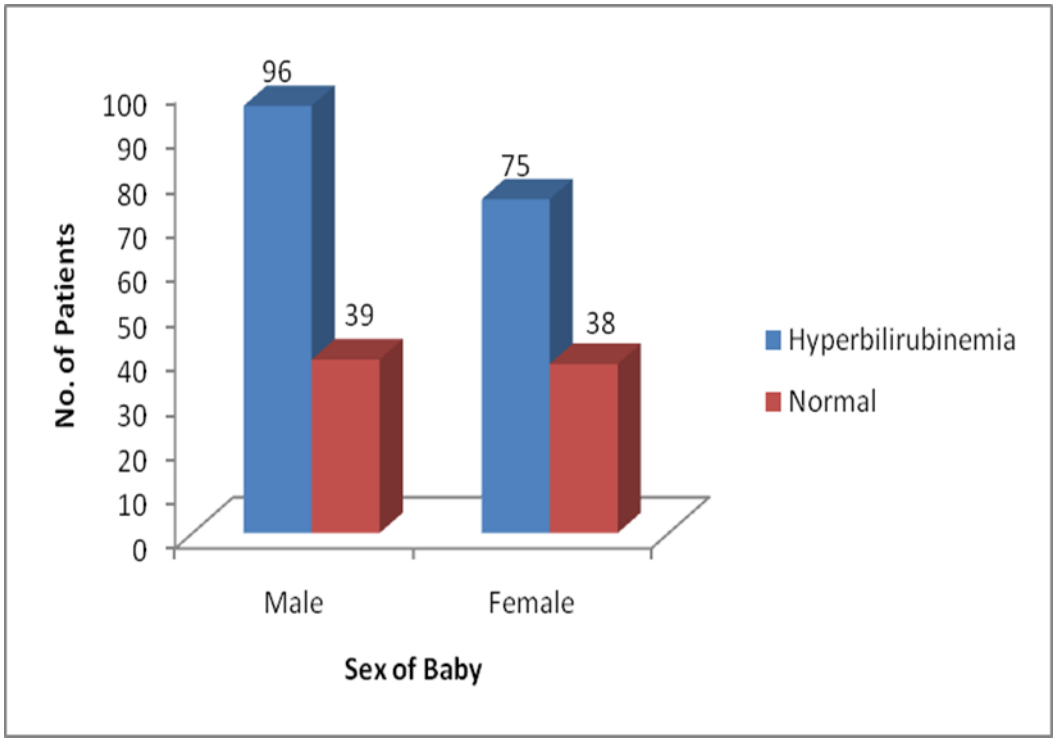
<2.85	155	0	155
	90.6%	0.0%	62.5%
>=2.85	16	77	93
	9.4%	100.0%	37.5%
Total	171	77	248
	100.0%	100.0%	100.0%

Chi-square Value	Df	p-value
182.274	1	<0.001

Sensitivity = 90.6%, Specificity = 100%, PPV = 100%, NPV = 82.8% , Accuracy = 93.6%

Figure 2 – Gender distribution and hyperbilirubinemia



4. Discussion

Neonatal hyperbilirubinemia is a common clinical condition encountered among healthy term neonates during the first weeks of life. It is characterized by the yellowish discoloration of the skin and occurs due to elevated levels of bilirubin in the blood. This condition can cause anxiety among parents and has the potential to be toxic to the central nervous system, resulting in behavioral and neurological impairment, known as BIND or Kernicterus. Neonatal hyperbilirubinemia can be caused by various risk factors, including low birth

weight, early membrane rupture, preterm birth, and maternal infectious illnesses that may lead to sepsis. In addition, molecular studies have shown associations between various genetic variants and neonatal hyperbilirubinemia.

The present study aimed to determine the value of cord serum albumin level as a predictive indicator of neonatal hyperbilirubinemia in healthy-term neonates. A total of 248 neonates were included in the study, of which 69% developed hyperbilirubinemia and 31% were normal. The incidence of hyperbilirubinemia observed in this study is consistent with previous studies [8].

Cord serum albumin level has been suggested as a surrogate marker for screening neonatal hyperbilirubinemia [9]. Aiyappa et al. found that the majority of infants needing phototherapy had a cord serum albumin level lower than 2.8 mg/dl, suggesting that cord serum albumin levels can be used to predict the development of hyperbilirubinemia. Our study is in line with these findings. Newborns with albumin levels below 3.3 g/dl require routine monitoring to track the progression of jaundice [10].

Based on the cord serum albumin levels, the study cohort was divided into two groups: Group 1 (cord serum albumin < 2.85 g/dl) and Group 2 (cord serum albumin > 2.85 g/dl). The majority of newborns in Group 1 developed jaundice, while a smaller percentage in Group 2 developed jaundice [11,12].

Lower cord serum albumin levels were associated with higher total serum bilirubin levels, indicating a strong correlation between cord serum albumin and neonatal hyperbilirubinemia. The mean day of life at which neonates developed hyperbilirubinemia was 3.2 days, which is consistent with the typical onset of jaundice on the third day of life [13,14]. There was no significant correlation between jaundice and the sex of the newborns or the mode of delivery [15]. However, significant correlations were observed between neonatal hyperbilirubinemia and cord serum albumin levels, Kramer staging, and the mean day of life.

The diagnostic predictability of cord serum albumin levels for neonatal hyperbilirubinemia was analyzed, and the results showed high sensitivity, specificity, positive predictive value, negative predictive value, and accuracy rate. These findings suggest that cord serum albumin levels can serve as an effective predictor of neonatal hyperbilirubinemia in healthy full-term infants.

In conclusion, neonatal hyperbilirubinemia is a common condition that can have detrimental effects on the central nervous system. Cord serum albumin levels have been identified as a valuable predictive indicator for neonatal hyperbilirubinemia. Monitoring cord serum albumin levels in healthy term neonates can help identify those at a higher risk of developing hyperbilirubinemia, enabling timely interventions and management strategies to prevent adverse outcomes. Further research is needed to explore the underlying mechanisms and potential interventions for neonatal hyperbilirubinemia.

Conflict of Interest

Authors do not have any COI

5. References

1. Venkatamurthy, M., Murali, S. M., et al. (2014). A comparison study: cord serum albumin is compared with cord serum bilirubin as a risk indicator in predicting neonatal jaundice. Journal of Evolution of Medical and Dental Sciences, 3(53), 12526-12533.
2. Mishra, A. K., Naidu, C. S. (2018). Association of cord serum albumin with neonatal hyperbilirubinemia among term appropriate-for-gestational-age neonates. International Journal of Pediatrics and Adolescent Medicine, 5(1), 1-6.

3. Ahmar, R., Parween, S., Kumar, A., Gupta, A. K. (2020). Cord Serum Albumin (CSA) Measurement and Prediction of Newborn Hyperbilirubinemia Based on CSA Values: Prospective Observational Study. Methodology, 7(2), 172-179.
4. Hegde, P. R. (2013). Cord serum bilirubin and albumin in neonatal hyperbilirubinemia. Int J Int Sci Inn Tech Sec A, 2(1), 46-51.
5. Kumar, S., Agrawal, K., Kumar, S., Chaturvedi, A. (n.d.). Risk Stratification of Term Neonates for Development of Significant Hyperbilirubinemia by Cord Serum Bilirubin and Albumin Ratio.
6. Kumar, S., Agrawal, K., Chaturvedi, A. (n.d.). Prediction of Significant Neonatal Hyperbilirubinemia on The Basis of Cord Serum Albumin Level in Healthy Term Neonates.
7. Huda, W. M., Sharma, P., Aggarwal, J., et al. (2021). A comparative study of cord blood bilirubin and albumin as a predictor for neonatal jaundice in term newborns. Journal of Datta Meghe Institute of Medical Sciences University, 16(1), 42-47.
8. Alalfy, M., El Lithy, A., EzzEldin, Z. M., Mansi, Y. A., et al. (2018). Role of bilirubin and albumin in cord blood as predictors for neonatal hyperbilirubinemia. Journal of Gynecology and Obstetrics, 6(3), 36-41.
9. Mohamed Reshad, Balasundaram Ravichander, Thiruchinappalli Subramaniam Raghuraman. "A study of cord blood albumin as a predictor of significant neonatal hyperbilirubinemia in term and preterm neonates." Int J Res Med Sci. 2016;4(3):887-890.
10. Suchanda Sahu, et al. "Cord blood albumin as a predictor of neonatal jaundice." International J. Biological and medical research 2011;2(1):436-438.
11. Mohamed Reshad, Balasundaram Ravichander, Thiruchinappalli Subramaniam Raghuraman. "A study of cord blood albumin as a predictor of significant neonatal hyperbilirubinemia in term and preterm neonates." Int J Res Med Sci. 2016;4(3):887-890.
12. Aiyappa G, Shriyan A, Raj B. "Cord blood albumin as a predictor of neonatal hyperbilirubinemia in healthy neonates." Int J Contemp Pediatr. 2017;4(2):503-506.
13. Daraz ZH, Shabir B, Afshan R. "Performance of cord blood albumin at birth for prediction of significant neonatal hyperbilirubinemia." EJPMR. 2019;6(6):800-807.
14. Ramteke S, Shrivastav J, Agrawal A, Mishra NR, Saravanan AT. "Comparison of cord bilirubin and bilirubin albumin ratio to predict significant hyperbilirubinemia in healthy full-term neonates." Indian J Child Health. 2018;5(2):108-111.
15. Rajpurohit N, Kumar S, Sharma D, et al. "To assess predictive value of cord blood bilirubin and albumin for significant neonatal hyperbilirubinemia: A Prospective Study from India." J Pediatr Neonatal Care. 2015;2(1):1-6.