

Original Article

Clinical Profile and Risk Factors for Hyperbilirubinemia in Newborns — A Prospective Cohort Study

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Abstract

Background : Neonatal hyperbilirubinemia is a common and usually benign problem in neonates during the first week of life. Present study aimed to assess the clinical profile and risk factors for predicting the hyperbilirubinemia among the newborn infants.

Material and Method : The present prospective cohort study was conducted in the newborn unit of AVMC College. The newborn expired during first 24 hours of life, having life threatening malformation were excluded from the study. Cord blood of 4 ml was collected after the delivery of the newborn and in EDTA and plain tube. The samples were processed for bilirubin, hemoglobin and reticulocyte counts. The values were correlated with the sample drawn after 48 hours of birth to assess the changes and prediction of the newborn developing hyperbilirubinemia requiring phototherapy.

Results : Total of 142 newborns fulfilling inclusion criteria were included in the study. Among them 53.5% were females and 46.5% were males. At the cut off of 1.8mg/dl of cord blood bilirubin to predict the need for phototherapy, the study found sensitivity of 94.29%, specificity of 64.72%, NPV of 86.21% and PPV of 58.41 with overall accuracy of 64.08%.

Conclusion : There was a significant positive correlation of the cord blood parameters like serum bilirubin and reticulocyte count with later development of hyperbilirubinemia.

Key words : Hyperbilirubinemia, Phototherapy, Prediction, Birthweight, Newborn.

Jaundice is a common disorder that occurs in the newborn¹⁻². Both physiological and pathological jaundice cause distress to parents². Jaundice is observed during the first week of life in approximately 60% of term and 80% of preterm infants. Lower gestational age, bilirubin level at phototherapy initiation and early termination of therapy are some of the risk factors for hyperbilirubinemia and readmission. Very few studies are available which looked at the problem of predicting the risk for hyperbilirubinemia³.

This study aims to find the prevalence, risk factors for hyperbilirubinemia and the usefulness of cord blood bilirubin and reticulocyte count in predicting its occurrence among inborn neonates. Studying the usefulness of cord blood parameters and after 48 hours of life for predicting hyperbilirubinemia will help taking early steps for reducing readmission rates and prevent complications of hyperbilirubinemia.

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Received on : 27/05/2023

Accepted on : 13/11/2023

Editor's Comment :

- Present study will contribute to predict the factors leading to rebound post phototherapy which help us manage babies with jaundice better.
- It will help in taking necessary steps for preventing rebound hyperbilirubinemia in local population.

MATERIAL AND METHOD

This Prospective cohort study was conducted after getting institutional ethical committee clearance from November, 2020 to August, 2022. This study included all inborn neonates. Neonates expired during first 24 hours of life and neonates presented with life threatening malformation were excluded. After delivery of the baby and clamping of umbilical cord, prior to expulsion of placenta cord blood sample about 4ml was collected in EDTA and plain tube. An automated analyzer was used for estimation of bilirubin, haemoglobin and reticulocyte count. Babies followed up for development of significant icterus. At 48 hours, venous blood sampling was done for serum bilirubin, reticulocyte count and haemoglobin. The level of cord blood and 48 hours of serum bilirubin, reticulocyte count and haemoglobin were correlated with development of neonatal jaundice.

How to cite this article : Clinical Profile and Risk Factors for Hyperbilirubinemia in Newborns — A Prospective Cohort Study. Panguraj A, Ballambattu VA, Mathivanan M. *J Indian Med Assoc* 2025; **123(10)**: 19-21.

RESULTS

In present study, total of 142 neonates fulfilling inclusion criteria were included with 53.5% females and 46.5% males. Among neonates included in this study, 9.2% were preterm. Out of 142, 70 babies required phototherapy. Predominant blood groups among recruited mothers were B+ve -35.2%, O+ve-31.7%, A+ve -25.4% respectively. Rh negative blood group was observed among 5.6% of mothers. Most of the preterm babies were late preterms and there was no significant increase among them for phototherapy requirement. Among the newborns 38% had O+ve, 35.2% B+ve and 12.7% A+ve blood groups (Table 1). Female babies required phototherapy significantly more often than male babies ($p<0.01$). Mode of delivery did not affect the requirement of phototherapy (Table 2). Correlation of cord blood bilirubin with after 48 hours venous blood bilirubin showed r value of 0.469* (Table 3). ROC curve drawn for cord blood bilirubin to predict requirement of phototherapy the Area Under Curve (AUC) of .723 showing significant association (Fig 1). There was a positive correlation between reticulocyte count and cord blood bilirubin of $<0.03^*$ and also with 48 hours venous blood bilirubin of $<0.001^*$ (Table 4).

DISCUSSION

Neonatal hyperbilirubinemia is a common and usually benign problem in neonates during the first week of

Table 1 — Distribution of newborn blood group among the study subjects

Blood group	Newborn blood group		Mother blood group	
	No	%	No	%
O+ve	54	38	45	31.7
B+ve	50	35.2	50	35.2
A+ve	18	12.7	36	25.4
AB+ve	15	10.6	3	2.1
B-ve	2	1.4	5	3.5
O-ve	2	1.4	1	0.7
A-ve	1	.7	2	1.4
Total	142	100	142	100

Table 2 — Comparison of mode of delivery and gender of newborn with requirement of phototherapy

		Phototherapy				Chi-square (p-value)
		No		Yes		
		Number	%	Number	%	
Mode	LSCS	44	61.1%	42	60.0%	6.431 (0.01)*
	NVD	28	38.9%	28	40.0%	
Gender	Female	31	43.1%	45	64.3%	
	Male	41	56.9%	25	35.7%	

Table 3 — Correlation of cord blood bilirubin with after 48 hours venous bilirubin levels among newborn

		Venous Blood Bilirubin Total (mg/dL) after 48 hours	
Cord blood Bilirubin Total (mg/dl)	r	0.469*	
	Sig.	0.001	

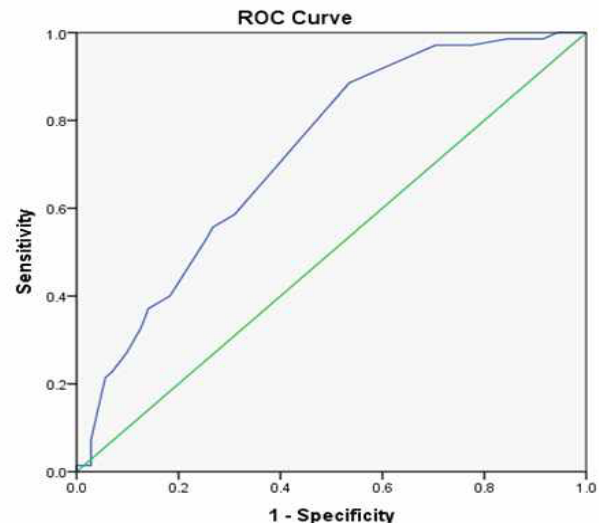


Fig 1 — ROC analysis to determine the cut off and AUC to predict requirement of phototherapy

Table 4 — Correlation of cord blood bilirubin with reticulocyte count and correlation of after 48 hours venous blood bilirubin and reticulocyte count

		Cord blood bilirubin	After 48 hours venous blood bilirubin
Reticulocyte count	Pearson correlation	0.182	0.377
	Sig (2-tailed)	$<0.03^*$	$<0.001^*$
	N	142	142

life³. Most common cause of hyperbilirubinemia in neonates is physiological jaundice. About 97% of full term and preterm neonates demonstrate a biochemical hyperbilirubinemia (serum bilirubin $>1\text{mg/dl}$) and about 65% appear clinically jaundiced [Total Serum Bilirubin (TSB) $>5\text{mg/dl}$].

Most of the earlier studies showed ABO and Rh incompatibility, male sex, previous affected siblings¹⁰⁻¹¹, gestational age less than 35 weeks, very low birth weight babies, polycythaemia, sepsis as risk factors¹². G-6PD deficiency, rapid decline in TSB and shorter duration of phototherapy were some of the risk factors for rebound bilirubin reported by another study¹⁻⁴. Breastfeeding and physiological jaundice were found to be protective factor for significant bilirubin toxicity¹³. Present study aimed to assess the

clinical profile and risk factors for predicting the hyperbilirubinemia among the newborn infants. Total of 142 newborn's fulfilling inclusion criteria were included in our study. By gestational age, 9.2% were preterm and 60.6% were delivered by LSCS. Garg, *et al*, documented marginal male predominance with 58% of infants⁷.

Phototherapy was required among 49.3% of infants. In newborn, majority were with the O+ blood group (38%). The present study showed a significant association of the presence positive correlation of cord blood bilirubin with the venous blood bilirubin done later, showing the importance of the cord blood parameters in predicting later development of hyperbilirubinemia.

Kumar, *et al*, documented that neonate with Unconjugated Hyperbilirubinemia caused by haemolytic causes had considerably higher initial bilirubin levels and decreased Haemoglobin levels at admission. Hemoglobin was considerably lower at 3 months, necessitating further transfusions. As a result, anaemia should be a major concern for such newborns not only upon admission but also during follow-up¹⁷. Thakkar, *et al*, documented that aberrant neurological findings on the seventh day of birth, when APGAR score of ≤ 6 at 10 minutes, and HIE grade II or above they were associated ($p = 0.01$).

In present study ROC curve was derived for the cord blood bilirubin to predict the requirement of phototherapy, it was found with Area Under Curve (AUC) of 0.723. At the cutoff level of 1.8mg/dl of cord blood bilirubin to predict the requirement of phototherapy, the study found sensitivity of 94.29%, specificity of 64.72%, NPV of 86.21% and PPV of 58.41 with overall accuracy of 64.08%.

CONCLUSION

Hyperbilirubinemia requiring phototherapy was detected in 49.3% of the newborns. There was a significant positive correlation of the cord blood parameters with the venous blood parameters estimated after 48 hours and positive correlation between cord blood bilirubin and reticulocyte count. There was no significant correlation between haemoglobin and bilirubin estimated after 24 hours of birth in predicting development of hyperbilirubinemia requiring phototherapy. This study had no neonates with exchange transfusion and there were not much preterm deliveries happened.

Compliance with Ethical Standards.

Funding : None

Conflict of Interest : None

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