ORIGINAL ARTICLE

Alkaline Phosphatase Levels as a Predictor of Neonatal Hyperbilirubinemia

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ABSTRACT

Background: Jaundice is a common health issue especially in pediatric practice. It can be physiological or pathological hence has supreme importance clinically.
Aim: To determine the accuracy of cord blood alkaline phosphatase levels for predicting neonatal hyperbilirubinemia. **Study Design:** Descriptive case series.
Methodology: It was conducted at Department of Pediatrics, Sir Ganga Ram Hospital-Lahore. All neonates fulfilling the inclusion criteria were enrolled. Their demographic information, gestational and birth history was taken. Cord blood sample (5ml) was taken and measured for ALP level and total bilirubin level. **Statistical analysis**: Data analyzed by using SPSS 23. Chi-square was applied.
Results: Predictive accuracy of cord blood ALP level for predicting neonatal hyper-bilirubinemia showing sensitivity and specificity as 91.60% and 93.04 respectively.
Conclusion: It was concluded that predictive accuracy of cord blood alkaline phosphatase level is good and reliable for predicting neonatal hyperbilirubinemia.
Keywords: Neonatal Hyper-bilirubinemia, Cord Blood Alkaline Phosphatase and Predictive Accuracy.

INTRODUCTION

Jaundice is a clinical finding indicated by yellow discoloration of the skin or sclera. It is a common finding among newborn infants. Bilirubin is a breakdown product of haemoglobin. Once its level rises in blood above baseline than hyperbilirubinemia develops. According to an estimate in various studies, its prevalence is 60% among term neonates and 80% among preterm babies[1,2].

Neonatal hyperbilirubinemia is a serious issue that needs timely treatment regardless of its origin. Literature review revealed that physiological neonatal jaundice does resolve spontaneously even if untreated but pathological jaundice if untreated leads to hyperbilirubinemia which causes brain damage. Bilirubin enters the brain either as free or albumin bound form thus damaging basal ganglia and other brainstem nuclei. Toxic hyper-bilirubinemia causes complications like visuocortical dysfunction minor motor dysfunction and kernicterus[2,3].

Literature review showed that newborn discharge within 02days should have a follow-up visit if significant jaundice develops. This follow-up visits are not feasible in our society due to lack of awareness thus fail to prevent nosocomial infections among newborns. This approach adds economic burden as well as failure to treat Jaundice at an early stage.

Early prediction of jaundice provides chance to treat babies who are at risk of neonatal hyperbilirubinemia thus minimizing their brain damage by high bilurubin. Prediction of hyperbilirubinemia by cord blood sample is safe, early and has reduced infection rate. In the light of above facts, literature review revealed that previously many other blood markers (H_2O_2, bilirubin, albumin, alpha fetoprotein) have been used to predict neonatal jaundice.[4-7] Alkaline phosphatase which is present in RBCs in abundance can be used to predict jaundice. Due to lack of available data in our community on this health issue, we planned current project in-order to reveal a possible correlation of its level and hemolysis[8].

The objective of the study was to determine the accuracy of cord blood alkaline phosphatase levels for predicting neonatal hyperbilirubinemia.

METHODOLOGY

This descriptive case series was conducted at Department of Pediatrics, Sir Ganga Ram Hospital-Lahore after IRB permission.. All neonates fulfilling the inclusion criteria were enrolled. Their demographic information, gestational and birth history was taken. Almost 5mm of cord blood sample at time of birth was collected to measure Alkaline phosphatase level and total bilirubin level. Serum ALP level was measured with auto analyzed. Infants with biochemical hyperbilirubinemia were recalled and serum bilirubin levels were measured and treated. All the term neonates both males and females above 2500gm were included while neonates with ABO and Rh incompatibility and G6PD deficiency were excluded.

Statistical analysis: Data analysis was done SPSS v23. Parameter like age and weight were presented as Mean±SD. Parameters like gender, hyperbilirubinemia, alkaline phosphatase and biochemicals were presented as frequency and percentage. Effect modifiers like gestational age and gender were applied. Chi-square test was applied while considering p-value (≤ 0.05) as significant.

RESULTS

The mean birth weight of all enrolled neonates was calculated as 2999.593±268.55gms. Parameters like gender distribution and hyperbilirubinemia were shown as frequency and percentage in table-1.

Table-1: Demographic Parameters of Neonates (n=246)

Parameters	Categories	Frequency	%age
Gender	Males	138	56.10
	Females	108	43.90
Hyper-bilirubinemia (Gold Standard)	Yes	131	53.25
	No	115	46.75
Hyper-bilirubinemia (Alkaline Phosphatase)	Yes	128	52.03
	No	118	47.97

Predictive accuracy of cord blood ALP level for predicting neonatal hyperbilirubinemia was calculated as 91.60%, 93.04% and 93.75% for sensitivity, specificity and positive predictive value as shown in table-2.

Table-2: ALP levels as predictor of Neonatal Jaundice

C.Blood Alkaline phosphatase	Biochemical evaluation	
	Hyperbilirubinemia (Positive)	Hyperbilirubinemia (Positive)
Positive	120(48.78%)	8(3.25%)
Negative	11(4.47%)	107(43.50%)

Stratification for predictive accuracy of cord blood ALP level for predicting neonatal jaundice with regards to gender was shown in table-3.

Table-3: Stratification of cord blood ALP level with Gender

C.Blood Alkaline phosphatase	Biochemical evaluation		P-value
	Hyperbilirubinemia (+ve)	Hyperbilirubinemia (+ve)	
Males			
Positive	66	4	
Negative	8	60	0.000*
Females			
Positive	54	4	
Negative	03	47	0.000*

*Statistically significant

Stratification for predictive accuracy of cord blood ALP level for predicting neonatal hyperbilirubinemia with regards to gestational age was shown in table-4.

Table-4: Stratification of cord blood ALP level with Gestational age

C.Blood Alkaline phosphatase	Biochemical evaluation		P-value
	Hyperbilirubinemia (Positive)	Hyperbilirubinemia (Positive)	
37-39 weeks			
Positive	62	4	
Negative	07	49	0.000*
40-42 weeks			
Positive	58	4	
Negative	4	58	0.000*

*Statistically Significant

DISCUSSION

Neonatal hyperbilirubinemia is a serious issue that needs timely treatment regardless of its origin. Literature review revealed that physiological neonatal jaundice does resolve spontaneously even if untreated but pathological jaundice if untreated leads to hyperbilirubinemia which causes brain damage. Alkaline phosphatase (hydrolase enzyme) which is present in RBCs in abundance can be used to predict jaundice.

One previous study reported that cord blood level of alkaline phosphates for neonatal jaundice had sensitivity and negative predictive value of 80% and 96.6% respectively in their study.[9] Similarly, our results showed that this particular enzyme had sensitivity (91.60%) and specificity (93.04%). Thus our results were in line with above mentioned study.

Another study used (alkaline phosphatase levels) as a predictor of jaundice at 6 hours after birth of baby. They reported that ALP levels were significantly higher (p-value 0.001) in neonates having jaundice especially those who required treatment (phototherapy or exchange transfusion).[10, 65] Present study, showed similar findings and reported significant correlation of ALP levels and neonatal jaundice.

Few others studies reported that mean levels of ALP in newborns were 325.24±85.03 IU/L and 159 ± 49 IU/L which were more than normal in neonates having jaundice.[11,12] Paradoxically, our results were different from above mentioned studies. Another

study showed that mean cord blood ALP level was 314.34 ± 122.42 IU/L.[13] However, it has been documented that average level of cord blood ALP in Iranian newborns seems to be higher than in other populations.

Limitations: We did not compare the adverse effects of the drugs and sample size was small.

CONCLUSION

It was concluded that predictive accuracy of cord blood alkaline phosphatase level was good and reliable for predicting neonatal hyperbilirubinemia. As indicated by results that jaundiced newborns had higher cord blood alkaline phosphatase levels than non-jaundiced newborns so it can be a useful tool in diagnosing hyper-bilirubinemia.

Author's contribution: RSU&NB: Conceptualized the study, analyzed the data, and formulated the initial draft, **SI & FT:** Analyzed the data

NM&RMU: Contributed to the analysis of data and proofread the draft, **TL:** Contributed to the proofreading the manuscript for intellectual content.

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