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A STUDY OF UMBILICAL CORD BILIRUBIN AS A PREDICTOR OF SIGNIFICANT NEONATAL JAUNDICE IN A TERTIARY RURAL CARE HOSPITAL

Neonatology

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ABSTRACT

Introduction. Around 80 percent of preterm infants and 60 percent of term infants are affected by neonatal jaundice in the first week of life. Early discharge of healthy term infants is a common practice because of economic constraints and social reasons. Which new-borns are at increased risk for developing significant hyperbilirubinemia (Total serum bilirubin ≥ 15mg/dl) is difficult to predict. This study was taken up to evaluate the predictive value of cord blood bilirubin level for identifying term infants for subsequent hyperbilirubinemia.

Material and methods. This prospective observational study was conducted in Adichunchanagiri Institute of Medical Sciences, Mandya, Karnataka from 1st of April 2020 to 30th September 2020. 100 healthy term babies satisfying the eligibility criteria and born in the study period were included in the study. Umbilical cord blood was collected and was correlated with serum bilirubin levels at 48hours of life. Significant hyperbilirubinemia was taken as ≥ 15mg/dl at 48 hrs of life.

Results. The incidence of neonatal hyperbilirubinemia was 14%. By using umbilical cord blood bilirubin ≥ 3mg/dl, significant hyperbilirubinemia can be predicted with Sensitivity of 92.9%, Specificity of 96.5%, Positive Predictive Value of 81.3% and Negative Predictive Value of 98.8%.

Conclusion. Umbilical cord blood bilirubin ≥ 3mg/dl in healthy term babies can help in prediction of significant jaundice and thus can help in identifying high risk new-borns so that these neonates can be followed up more closely, it can also help in identifying neonates who are not at increased risk of developing significant jaundice, hence can prevent unnecessary hospital stay.

KEYWORDS

INTRODUCTION

The most common condition requiring medical attention in the neonatal period is Jaundice.[1]

Around 80 percent of preterm infants and 60 percent of term infants are affected by it in the first week of life.[2]

The incidence of hyperbilirubinemia depends of the method of bilirubin estimation in different laboratories, breast feeding frequency and, on the ethnic, makeup of the people.[3-5]

In new-borns if significant hyperbilirubinemia for age is promptly identified and treated, bilirubin-induced neurologic dysfunction can be prevented.[6-7]

Early discharge of healthy term infants is a common practice because of economic constraints and social reasons.[8]

During the early neonatal period hyperbilirubinemia is the most common cause of readmission in a significant number of babies.[9]

These readmission leads to burden of extra expenses on the family and exposes the healthy new born to hospital environment and also poses risk for interruption of breast feeding.[16]

Some full-term healthy new-borns who are discharged early can also suffer from severe jaundice and kernicterus with no early findings of hemolysis.[10]

Which new-borns are at increased risk for developing significant hyperbilirubinemia (Total serum bilirubin ≥ 15mg/dl) is difficult to predict.[11]

New-borns who are discharged within 48 hours of birth should have a follow up visit after 2-3 days to detect significant neonatal hyperbilirubinemia and other issues according to American Academy of Paediatrics recommendations (AAP) but following of this guideline is not feasible in our country because of limited follow up facilities.[12]

Thus, because of early discharge the detection, follow up and providing early treatment of jaundice has become more difficult.

Present study was taken up to evaluate the predictive value of cord blood bilirubin level for identifying term infants for subsequent hyperbilirubinemia.

Exchange transfusion is required for treating severe hyperbilirubinemia which is costly, consumes time, requires skilled labour and is associated with many complications. whereas the early treatment of phototherapy is cheap, simple and effective.[13-15]

It's a need of the hour to develop simple predictive guidelines which will help the paediatricians to identify or predict which of the new-borns who are discharged early are at increased risk of developing significant hyperbilirubinemia and reduce the risk of developing kernicterus.

For prediction of neonatal hyperbilirubinemia many methods have been suggested such as physical examination, using risk factor table for evaluation, prediscahrge transcutaneous bilirubin measurement and measuring expiratory carbon monoxide levels.

Prediction of neonatal hyperbilirubinemia using cord blood bilirubin has been studied by various investigators, but the results were not consistent.[17,18,19.]

This study was taken up to evaluate the predictive value of cord blood bilirubin level for identifying term infants for subsequent hyperbilirubinemia.

MATERIAL AND METHODS

Study Place	:	Study was conducted in Tertiary Rural Care Hospital i.e. Adichunchanagiri Institute of Medical Sciences

Study Duration	:	1st of April 2020 to 30th September 2020
Study Subjects	:	Healthy term babies born in Adichunchanagiri Institute of Medical Sciences
Study Design	:	Prospective Observational Study
Study Size	:	100 healthy term babies satisfying the eligibility criteria born in the study period

INCLUSION CRITERIA:

1) Babies born at >37 weeks of gestation

EXCLUSION CRITERIA:

1) ABO incompatibility
2) Rh incompatibility
3) Illness requiring NICU admission
4) Out born babies
5) Babies having major congenital anomalies
6) Babies receiving drugs that are known to affect serum bilirubin levels
7) Pathological jaundice

Using the above selection criteria 100 healthy term babies were selected born in Adichunchanagiri Institute of Medical Sciences, Mandya.

Informed written parental consent was taken. Data was collected in a preformed Performa. Maternal case file and new-born examination were used for obtaining the required data. Detailed medical history was obtained and gestational age of the baby was confirmed by New Ballard score.

Cord blood sample was collected and was sent for following investigations-

1) Baby blood group and Rh factor
2) Baby cord blood bilirubin-
   Total
   Direct
   Indirect

For the present study Cord blood bilirubin more than or equal to 3mg/dl was defined as Cord blood hyperbilirubinemia.

Venous blood sample for the neonate were sent at 48hrs of life for the following investigation-

Serum bilirubin- Total/Direct/Indirect

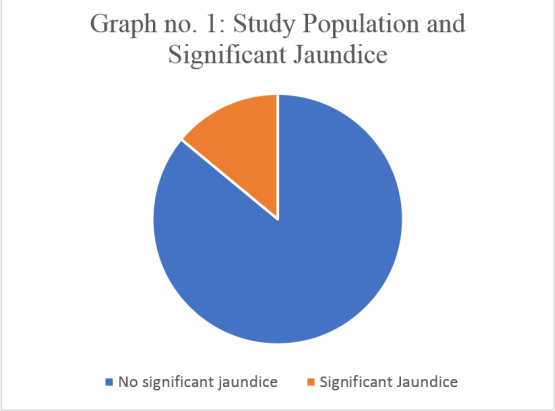
Collected blood sample was stored away from light. The collected sample was stored at 2-8°C till test is done. Diazotized sulfanilic test was used for bilirubin estimation and test was done within 12 hours of sample collection. Serum bilirubin ≥ 15mg/dl after 48hours of life was taken as significant hyperbilirubinemia requiring phototherapy as per the guidelines given by AAP and IAP-NNF.

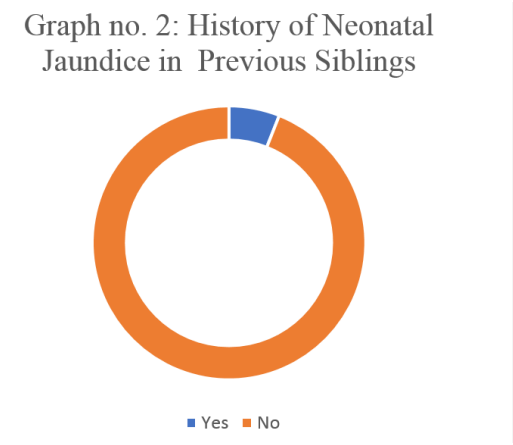
STATISTICALANALYSIS-

Data thus obtained was compiled and entered in MS Excel spread sheet; descriptive statistics was applied, cross tables were constructed, data was expressed in terms of frequency and percentage.

RESULTS

The incidence of significant hyperbilirubinemia in our study was 14%. (Graph no.1)





In the present study 6% of newborns had history of neonatal jaundice in previous siblings. (Graph no.2)

TABLE NO. 1 Maternal details	No. of mothers	Total percentage	Significant Hyperbilirubinemia
Mother age (Years)			
<20	6	6%	33.3
20-30	85	85%	14.1
>30	9	9%	0
Parity			
Primi	66	66%	10.6
Multi	34	34%	20.5
Blood group of mothers			
O+	25	25%	20%
B+	33	33%	9%
A+	40	40%	15%
AB+	2	2%	0%
Total	100	100%	

In our study majority of the mothers belonged to age group of 20-30 years. Majority of the mothers were Primi (66%). The most common maternal blood group was A+. (Table no. 1)

TABLE NO. 2 Newborn Details	Number of Neonates	Total percentage	Significant Hyperbilirubinemia
Sex			
Male	53	53%	11.3%
Female	47	47%	17%
Gestational age(wks)			
37-38	72	72%	16.6%
39-40	26	26%	7.69%
>40	2	2%	0%
Birth weight (Kg)			
2.50-2.99	61	61%	11.4%
3-3.49	28	28%	25%
≥3.5	11	11%	18.1%
Baby blood group			
A+	36	36%	13.8%
B+	33	33%	9%
O+	31	31%	19.3%
AB+	0	0%	0%
Total	100	100%	

Our study included 53 male and 47 female babies and majority of them were born at 37-38 weeks of gestation (72%).

Maximum number of babies had birth weight in the range of 2.5-2.99 kgs. The most common baby blood group was A+ (36%). (Table no. 2)

TABLE NO.3 Oxytocin used	No. of Neonates	Total Percentage	Significant Hyperbilirubinemia
Yes	24	24%	16.6%
No	76	76%	13.1%

In our study 24 babies were delivered after oxytocin induction out of which 4 babies developed jaundice whereas 76 babies were delivered without oxytocin induction out of which 10 babies developed jaundice. (Table no. 3) (Graph no. 3)

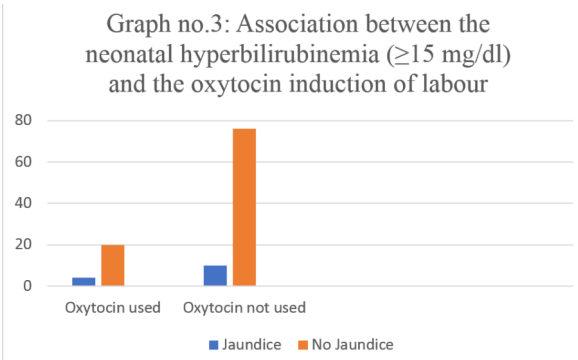


TABLE NO.4 Cord blood bilirubin at birth (mg/dl)	Serum bilirubin at 48hrs of life	
	≥15mg/dl	<15mg/dl
≥3	13	3
<3	1	83

In present study 16 babies had cord bilirubin ≥ 3mg/dl out of which 13 babies developed significant hyperbilirubinemia at 48 hours of life while out of 84 babies who had cord bilirubin of less than 3mg/dl, one baby developed significant hyperbilirubinemia. (Table no.4)

TABLE NO.5 DIAGNOSTIC PREDICTABILITY OF CORD BLOOD TOTAL BILIRUBIN OF ≥ 3MG/DL FOR HYPERBILIRUBINEMIA AT 48HOURS OF LIFE	
Sensitivity (%)	92.9%
Specificity (%)	96.5%
Positive Predictive Value (%)	81.3%
Negative Predictive Value (%)	98.8%

In our study the Positive Predictive Value of cord blood total bilirubin ≥3mg/dl for hyperbilirubinemia at 48 hours of life was 81.3% while Negative Predictive value was 98.8%.

If the newborn had significant hyperbilirubinemia the probability that cord blood bilirubin was more than 3mg/dl was 92.9%. The probability that the cord blood bilirubin is less than 3mg/dl in a Non Hyperbilirubinemic neonate was 96.5%. (Table no.5)

DISCUSSION

Hyperbilirubinemia in neonates is a common condition. 80% of preterm and 60% of term infants develop jaundice during 1st week of life.

At birth serum bilirubin levels are 1-3mg/dl and gradually rises at a rate of less than 5mg/dl per day.

In our study we presumed that high bilirubin level at birth can also help in prediction of serum bilirubin at day three of life. This study aimed to find the relationship between cord blood bilirubin and serum bilirubin levels at 48 hours of life which may help in predicting significant hyperbilirubinemia in neonates.

Cord blood was chosen for initial bilirubin estimation as it is a simple, non-invasive method and doesn't cause any discomfort to the baby and the result of bilirubin levels is readily available.

The effect of oxytocin in labour in causing neonatal jaundice has been proved by many studies.[20-21]

Oxytocin causes hypo-osmolality and hyponatremia in the mother because of its saluretic and anti-diuretic effects. When oxytocin is given with electrolyte free dextrose solution, these biochemical changes are escalated. This causes increased RBCs osmotic fragility in the foetus as this this hypo-osmolar solution is transferred to foetus trans placentally. The spleen destroys these swollen RBCs which results in increased bilirubin production.

There is a re-emergence of Kernicterus because of growing practice of early discharge of new-borns.

Hence, it is of utmost importance to develop some markers for identifying new-borns who are at increased risk of developing significant hyperbilirubinemia.

All new-borns who are discharged within 48 hours of birth should be followed up within 2-3 days of discharge according to AAP recommendation to rule out significant jaundice and other health problems. However, this is not feasible in our country especially in rural areas because of social and financial constraints.

Clinically severe jaundice is often missed, which indicates that trigger for measuring the first serum bilirubin level and determining further recommendation is not set. Moreover, in majority of the neonates who developed bilirubin related neurologic damage, significant hyperbilirubinemia is almost always present before the first hospital discharge, concluding from the level of total serum bilirubin for age in hours at readmission. This shows that either early icterus has been missed or its severity for postnatal age was not realised.

Presently we don't have a reliable technique of predicting such levels of hyperbilirubinemia.

Babies who are discharged withing few days after birth can be assessed for significant hyperbilirubinemia by using umbilical cord blood for prediction of significant jaundice. It can also help to identify neonates who are at decreased risk of hyperbilirubinemia and hence can decrease the unnecessary hospital stay of the baby.

Taking all these factors into consideration this present study was done on healthy term babies with non Hemolytic jaundice. Serum bilirubin values more than or equal to 15mg/dl was considered as significant hyperbilirubinemia.

Incidence of Hyperbilirubinemia-

Different studies have found inconsistent incidence of neonatal hyperbilirubinemia.

In our study incidence of hyperbilirubinemia was 14%.

TABLE NO.6 Comparison of incidence of Hyperbilirubinemia in different study with present study.	Incidence of Hyperbilirubinemia
Rajput G. and Dhanawade S.[22]	22%
Taksande et al[18]	19%
Hamdi et al[23]	26%
Randev S et al.[24]	12%
Present study	14%

In the present study using umbilical cord blood bilirubin level ≥3mg/dl we were able to predict significant hyperbilirubinemia with a positive predictive value of 81.3%, negative predictive value of 98.8% with a sensitivity of 92.9% and specificity of 96.5%.

TABLE NO.7- Studies on the predictive ability of cord blood bilirubin level and the Neonatal Hyperbilirubinemia

Studies	Cord blood bilirubin cut off (mg/dl)	Significant Hyperbilirubinemia (mg/dl)	Sensitivity	Specificity	PPV	NPV
Knudsen[25]	>2.35	>15	13%	99%	85%	72%
Nilesh Ahire et al[26]	≥3	>15	100	98.17	66.67	100
Rajput G. and Dhanawade S.[22]	>2	>15	86	40	29	91
Rajpurohitet et al[27]	>3	>17	91.67	84.52	45.83	98.61
Taksande et al[18]	≥2	>17	89.5	85.1	38.6	98.7
Present study	≥3	>15	92.9	96.5	81.3	98.8

CONCLUSION

Approximately 85% of readmissions of term neonates is because of neonatal jaundice. These can be prevented if babies at risk of developing significant hyperbilirubinemia are identified early and managed appropriately which in turn will help us in reducing the bilirubin induced neurological damage.

Neonates having cord blood bilirubin level ≥ 3mg/dl should be

followed up more closely to avoid morbidity and mortality that can be caused by neonatal jaundice.

Oxytocin can give rise to hyperbilirubinemia in the newborn by inducing hemolysis and should be used with caution.

A NPV of 98.8% will help us in identifying neonates who are not at increased risk of developing significant jaundice. Hence, needless hospital stay can be avoided.

Thus, prediction of significant neonatal hyperbilirubinemia by cord blood bilirubin level ≥3mg/dl will have extensive implication in our rural hospital.

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CONFLICT OF INTEREST
There are no conflicts of interest.

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