

Research Article

Prediction of neonatal hyperbilirubinemia using first day serum bilirubin level

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ABSTRACT

Background: The new born needs the utmost care for all the neonatal problems for its better outcome in the future and neonatal hyperbilirubinemia is one of them and with its timely detection and management a good prognosis can be predicted. The main objective is utility of first day serum bilirubin level in predicting subsequent development of neonatal hyperbilirubinemia in term and near term babies. It is a Prospective study Design. Setting :Tertiary care medical college.

Methods: Total of 213 babies was included in the study. Sick and Rh incompatible babies were excluded. Serum bilirubin estimated on day1 of life and subsequently repeated on day3 and day5 in whom 1st day value was more than 6mg/dl, statistical analysis was done.

Results: The risk of subsequent development of hyperbilirubinemia is <1% compared to 27.2% when 1st day bilirubin level was <6mg/dl or >6mg/dl ($p<0.01$). The incidence was much less in exclusive breastfed babies. Male preponderance was seen. Vaginally delivered babies were more prone to develop jaundice later compared to babies born by LSCS ($P<0.003$). Sensitivity was 100% and specificity was 60% in picking babies who required phototherapy for high bilirubin values.

Conclusions: Mean serum bilirubin level of 6 mg/dl in the first 24 hours of life was determined to have the highest sensitivity to predict the new-borns that would develop significant hyperbilirubinemia. There were no significant differences between the cases who did and who did not develop significant hyperbilirubinemia with respect to various risk factors.

Keywords: Neonatal hyperbilirubinemia, First day serum bilirubin, Term neonates

INTRODUCTION

The new born needs the utmost care for all the neonatal problems for its better outcome in the future and neonatal hyperbilirubinemia is one of them; with its timely detection and management a good prognosis can be predicted. Discharging healthy term babies from the hospital after delivery at increasingly earlier postnatal ages has recently become a common practice for medical, social and economic reasons. However, it has been seen that newborns whose post-delivery hospital stay is less

than 72 hours are at a significantly greater risk for readmission than those whose stay is >72 hours.¹⁻⁵ Hyperbilirubinemia is the most commonly reported cause of readmission during the early neonatal period.^{1-3,5-9} In United States, there were 22 reported cases of kernicterus developing after discharge within 48 hours of birth between 1991 and 1995.¹⁰ Furthermore, the safety of relying on follow-up visits after early discharge is questionable because 10% of the population fail to return for a follow-up visit.¹¹ Several cord blood parameters have been studied before in an attempt to anticipate the

clinical course of a neonate with ABO incompatibility but the usefulness of first-day bilirubin measurement to predict the future clinical course is seemingly a new concept.

Therefore we investigated the value of first-day bilirubin measurement in predicting the development of significant hyperbilirubinemia later in term and near term neonates by measuring serum bilirubin levels on day1,day3 and day 5 so that high risk babies can be picked early and can be kept in hospital for observation and treatment if required.

METHODS

The present study was a prospective study and was conducted in neonatal wards and NICU of Konaseema institute of medical sciences, Amalapuram, Andhra Pradesh, India from May 2014 to May 2015. The study population included the near term (35 weeks-38 weeks) and full term healthy babies. Serum bilirubin estimation was done by modified jendrassik method on 1st day of life and bilirubin level >6mg/dl on 1st day were followed every 24±6 hours upto five days. Serum bilirubin estimation was done on day 1, day 3 and day 5. All sick newborn babies and babies with Rh incompatibility were excluded from the study.

Detailed clinical history was recorded with special reference to antenatal, natal, postnatal periods in each case as per a structured proforma. Detailed clinical examination was performed noting gestational age, birth weight somatic and neurological maturity of each baby. Complete blood count, reticulocyte count, differential count, blood group including Rhesus, direct antiglobulin test, hepatic and renal function, serum direct and indirect bilirubin levels, C-reactive protein were performed

routinely in all cases. Serum total bilirubin was estimated in the first 24 hours of life (mean 17 hours; range:6-24 hours) and was repeated daily for the next 5 days, performing each measurement 36 hours after the previous measurement. Babies with total serum bilirubin level of >17mg/dl after 24 hours of life were defined to have significant hyperbilirubinemia, and those cases underwent phototherapy treatment if their bilirubin level exceeded 20mg/dl on follow-up. In all cases gender, birth weight, gestational age, delivery route, feeding pattern, maternal age, apgar score, chronic illness in mother, other sibling affected with jaundice were documented. Informed consent was obtained from all parents of the new-borns enrolled in the study.

Statistical data were analyzed with the independent sample t test, descriptive analysis and χ^2 tests. The critical serum total bilirubin level measured in the first 24 hours of life having the highest sensitivity was determined with the receiver operating characteristic (ROC) curve analysis. The outcome of the cases was recorded as per the duration of hospital stay, received treatment or otherwise discharged.

RESULTS

Total of 205 babies were initially enrolled for the study. 10.10 of those did not come for follow-up. 3 babies were diagnosed to have sepsis based on clinical and laboratory findings and hence excluded from the study. 2 babies were born to hypothyroid mother so planned to do screening thyroid profile after 48 hours of life as per standard protocol so 1st day bilirubin was not estimated hence excluded. Below given Table 1 shows baseline demographic characters with 1st day serum bilirubin level.

Table 1: Demographic characters with 1st day serum bilirubin level.

| Demographics | Bilirubin<6mg/dl n=120 | Bilirubin>6mg/dl n=70 | P value |
|-----------------------------------|---------------------------|--------------------------|---------|
| Gender (m/f) | 70/50 | 50/20 | 0.613 |
| Birth weight in grams | 2800±300 | 2800±300 | 0.551 |
| Gestation weeks | 38±2 | 38±2 | 0.716 |
| Delivery mode (vaginal/caesarean) | 75/45 | 50/20 | 0.493 |
| APGAR score | 8 | 8 | 0.094 |
| Breast feeding | 90 | 55 | 0.662 |
| Formula feed | 30 | 15 | 0.110 |
| Gest acq diseases | 5/115 | 2/68 | 0.095 |
| Enclosed hemorrhage | 0/120 | 0/90 | 0.414 |
| Sibling with jaundice | 10/110 | 4/66 | 0.312 |

This table shows demographic characteristics of cases who had a serum total bilirubin level of <6mg/dl and >6mg/dl in the first 24 hours. Serum bilirubin value of

>6mg/dl on first day was more in males and vaginally delivered babies, Exclusive breast feeding and previous sibling with jaundice were not good predictors. 67% of

the babies were found to have bilirubin level of either 6 or less out of which only 1% developed jaundice later on whereas 33% babies had first day bilirubin more than 6 out of which 23% babies later developed jaundice, sensitivity 90%, specificity 77.4%, positive predictive value 23.2% and negative predictive value 94%. Early bilirubin level on first day of life as a good predictor of subsequent hyperbilirubinemia is shown in the Table 2 below with measurements being done on first, third and fifth day.

Table 2: Early bilirubin level as a predictor of hyperbilirubinemia.

| Hyperbilirubinemia | Day 1 | Day 3 | Day 5 |
|---------------------|-----------|-----------|-----------|
| Significant (15) | 7.10±1.27 | 13.1±1.81 | 18.5±1.35 |
| Insignificant (175) | 5±0.85 | 9.85±1.56 | 11.5±2 |
| P value | <0.01 | <0.01 | <0.01 |

Values are given as mean± standard deviation with 95% confidence interval

The above table showing the first five days bilirubin levels of the cases who did and who did not develop significant hyperbilirubinemia after 72 hours of age, with p value <0.01. The cases with significant hyperbilirubinemia were seen to have slightly low hemoglobin level. The incidence is much less in exclusively breast fed babies. There is a male preponderance and the incidence is more in normally delivered babies as compared to caesarean section.

DISCUSSION

Although there has been a decrease in the length of post-delivery hospital stay for newborns, there is still much controversy about early or late discharge of mother baby dyad. Opponents of early discharge suggest many associated risk factors like hyperbilirubinemia, breast feeding difficulties, missed identification of congenital anomalies, maternal post-partum cognitive deficits.¹²⁻¹⁶ In various studies from different countries investigating the predictive value of first day serum bilirubin measurement on predicting the later development of significant hyperbilirubinemia has been reported to be between 1.7% to 12%. Bhutani et al have prospectively followed term newborns over the first 5 days of life by measuring serum bilirubin levels daily.^{15,16} In their series of 1097 newborns, no infant who had a bilirubin level of <5mg/dl at 20 to 28 hours of life developed significant hyperbilirubinemia (≥ 17 mg/dl), whereas 33% of those whose bilirubin level at the same hours was at least 8mg/dl developed significant hyperbilirubinemia.¹⁷ In our study 23% babies subsequently developed jaundice with first day bilirubin being more than 6mg/dl. In a similar study by Seidman et al, the risk of significant hyperbilirubinemia was 1.6% in cases whose bilirubin level was <5mg/dl at 24 hours of life, whereas that risk was 6.6% in cases whose bilirubin level was 5mg/dl at 24

hours of life.¹⁸ In our study the bilirubin level of 6 mg/dl on the first day had the good sensitivity, and predicted 90% of the babies who developed jaundice later on. In a study conducted at Govt. medical college, Vadodara, India by Vailaya RCG et al found total serum bilirubin level of 4.4mg/dl was the best cut off on first day and 6.55mg/dl was the best cut off on second day for subsequent development of hyperbilirubinemia.¹⁸ A risk stratification model with 6 distinct risk levels was developed by taking outcomes of a large cohort of newborns in china by measuring transcutaneous bilirubin levels, for the timely follow-up of post discharge hyperbilirubinemic patients thus reflecting the importance of first day bilirubin level usefulness in a developing country like india.¹⁹ This approach can also be applied to preterm neonates as shown by Mayer et al, bilirubin being measured at 12th hour of life to pick the at risk babies earlier so that phototherapy can be instituted timely, thus avoiding the fatal complication of kernicterus.²⁰

Our study has got some limitations. Only term or near term babies were included. Various different perinatal factors like feeding, oxytocin use etc. Sepsis could be contributory to development of jaundice but were never analysed.

CONCLUSION

Therefore from our experience, we conclude that a serum bilirubin measurement and the use of critical bilirubin level of 6mg/dl in the first 24 hours of life will predict nearly all healthy term newborns that will have significant hyperbilirubinemia and will determine all of those infants who will require phototherapy treatment later during first days of life. However our study population included only 213 babies, larger cohort study may further provide the desired results with more accuracy so that national guidelines can be set in a resource constrained country like India.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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