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Original Research Article

WEIGHT LOSS AT 24 AND 48 HOURS OF LIFE AS PREDICTOR OF SIGNIFICANT NEONATAL HYPERBILIRUBINEMIA

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ABSTRACT

Background: Aim: Neonatal hyperbilirubinemia is a common morbidity in the early neonatal period and a preventable cause of neurological injury. Early identification of infants at risk is clinically important. This study aimed to evaluate whether percentage weight loss at 24 and 48 hours of postnatal life could predict significant neonatal hyperbilirubinemia requiring treatment within the first seven days of life, and to assess associated antenatal, natal, and postnatal factors. **Materials and Methods:** This longitudinal cohort study was conducted over one year in the postnatal wards of a tertiary care hospital in Kerala, India. Clinically stable neonates born at ≥35 weeks of gestation and exclusively breastfed for the first 48 hours were enrolled. Birth weight and repeat weights at 24 and 48 hours were recorded and percentage weight loss was calculated. Neonates were periodically assessed for jaundice and treated based on American Academy of Pediatrics guidelines. Infants were followed up until seven days of life. Correlation analysis and receiver operating characteristic (ROC) curves were used to evaluate the predictive utility of early weight loss. **Results:** Of the 314 neonates included, 93 (29.6%) required phototherapy after 48 hours of life. Weight loss at 24 hours showed a significant positive correlation with transcutaneous bilirubin levels (r = 0.377, p < 0.001), while weight loss at 48 hours did not. ROC analysis demonstrated poor predictive accuracy of weight loss at both time points. Maternal hypertension was the only factor significantly associated with the need for treatment. **Conclusion:** Early postnatal weight loss at 24 and 48 hours does not reliably predict significant neonatal hyperbilirubinemia requiring treatment. Exclusive breastfeeding should be continued, and comprehensive bilirubin monitoring remains essential irrespective of early weight loss patterns.

INTRODUCTION

Neonatal hyperbilirubinemia is the most common medical condition requiring monitoring and therapeutic intervention in immediate neonatal period and a frequent cause of hospital readmission in the early neonatal life.[1] Approximately 60% of term and 80% of preterm infants develop jaundice during the first week of life.[2] The overall incidence of severe hyperbilirubinemia (total serum bilirubin >15 mg/dL) among Indian newborns has been reported to be 3.3% in intramural neonates and 22.1%in extramural neonates.[3]

With early bilirubin monitoring and adherence to standardized management protocols,[4,5] the incidence of bilirubin encephalopathy has markedly declined in

high income countries.[6] However, undertreatment and delayed recognition continue to pose significant challenges in low and middle income countries where Bilirubin Induced Neurological Dysfunction (BIND) remains a major cause of preventable neurodevelopmental morbidity. [7]

Exclusive breast feeding is a well-recognized risk factor for exacerbation of neonatal hyperbilirubinemia. Factors like calorie deprivation due to feeding difficulties, increased enterohepatic circulation and presence of inhibitors of bilirubin conjugation in breast milk have been implicated.[8] Concurrently the length of hospital stay for mothers and neonates has declined worldwide because of the influence of many social, financial and health care system factors. This early discharge often limits

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opportunities for adequate monitoring of neonatal jaundice, particularly in remote or resource limited settings where the provisions for invasive or non invasive monitoring of newborns for hyperbilirubinemia may be also limited. Unrecognized feeding inadequacy can contribute to excessive weight loss and potentially significant hyperbilirubinemia, increasing the risk of neurological injury.

Given the wide variation in breastfeeding practices, early neonatal care and the prevalence of conditions like G6PD deficiency across different regions, studies addressing the predictors of neonatal hyperbilirubinemia in the Indian context are of particular relevance.

The study was therefore undertaken to evaluate whether percentage weight loss at 24 and 48 hours of postnatal life could predict significant neonatal hyperbilirubinemia in the first seven days of life. Additionally, the study aimed at assess the association of significant neonatal hyperbilirubinemia in this period with selected in antenatal, natal and postnatal factors.

MATERIALS AND METHODS

A longitudinal single cohort study was conducted in the postnatal wards of Government Medical College, Ernakulam in Kerala over a period of one year from December 2024 to November 2025

Open Epi software was used for calculating sample size. Based on a reference study reporting an incidence of significant hyperbilirubinemia of 29.3% among infants with weight loss of ≥8% at 48 hours of life, the required sample size was estimated to be 314. Neonates born at ≥35 weeks of gestation at Government Medical College, Ernakulam who were clinically stable to be weighed within one hour of birth and who could be left for exclusive breast feeding was enrolled in the study after getting informed consent from the parent or responsible caretaker. Gestational age was determined using the Expected Date of Confinement based on Last Menstrual Period and/or early ultrasound. In cases of unavailability of both or discrepancy exceeding one week, Expanded New Ballard Score (ENBS) was used.

Babies birthweight was recorded within one hour of life using electronic weighing machine accurate to 10 g, after removing all clothes and following a standardized protocol. The weighing scale was routinely calibrated using standard weights. Neonates were exclusively breastfed. Subsequent weights were recorded at 24 hours and 48 hours of life using same methodology. Percentage weight loss was calculated as:

Weight loss percentage = (Birth weight- current weight)/birth weight X 100

Neonates were assessed clinically for jaundice every 12 hours and by transcutaneous bilirubinometry (TcB) every 24 hours. TcB values were plotted against the American Academy of Paediatrics (AAP)hour specific bilirubin normograms. If TcB values or clinical assessment indicated the need for intervention, blood samples were obtained for total serum bilirubin(TSB), Hemoglobin, Reticulocyte count and peripheral smear. The requirement for phototherapy was determined based on total serum bilirubin levels according to AAP guidelines.

Neonates who did not require phototherapy during hospital stay were followed up at seven days to assess the development of jaundice requiring treatment and to document feeding practices.

Exclusion Criteria: All outborn babies, babies whose birthweight could not be recorded within one hour of birth, those who received IV fluids or feeds or fluids other than breast milk within the first 7 days of life, babies requiring phototherapy or exchange transfusion within the first 48 hours of life, babies with incomplete weight measurements at 24 and 48 hours of life and babies who developed clinical or laboratory evidence of sepsis or hemolysis anytime within the first seven days of life were excluded from the study. Babies who had an incompatibility setting (Mother O positive and baby A positive, B positive or AB positive, or Mother Rh negative and baby Rh positive) and developed jaundice anytime in the first 7 days were also excluded irrespective of status of hemolysis while those in the same setting who did not develop significant jaundice and had no evidence of hemolysis were not excluded.

Statistical Analysis: Data were coded and entered into Microsoft Excel which was re-checked and analyzed using SPSS statistical software version 25. Normality was assessed using Shapiro-Wilk test. Quantitative variables were expressed as mean ± standard deviation or using median and interquartile range (IQR) as appropriate. Categorical variables were expressed as frequency and percentage. Independent sample t test or Mann Whitney test was used to test statistical significance of difference between different independent groups depending upon normality of distribution. Pearson Chi-square test or Fisher's Exact test was used for comparing categorical variables. Spearman correlation test was applied to assess the relation between weight loss percentage and transcutaneous bilirubin level at 24 hours and 48 hours of life. ROC curves were generated to evaluate the diagnostic utility of weight loss at 24 hours and 48 hours in predicting significant hyperbilirubinemia requiring treatment. A p value of <0.05 was considered statistically significant.

RESULTS

A total of 314 neonates born at ≥ 35 weeks of gestation were included. Table 1 shows the baseline characteristics of study subjects. 170 (54.1%) were females. Most neonates (78.1%) were born between 37 weeks and 39 weeks + 6 days while 60 (19.1%) were late preterm (35- 36 weeks + 6 days).

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The mean birth weight was 2824.25 ± 414.49 g. 70 neonates (22.3%)had birth weight < 2500g and 3 babies (1%) weighed > 4000 g. 176 (56.1%) babies were delivered through normal vaginal delivery.

Maternal comorbidities included Gestational Diabetes Mellitus(GDM) in 47 (15%), hypertension in 30 (9.5%) and hypothyroidism in 20 (6.4%). Other antenatal complications were also documented.

All neonates were exclusively breastfed for the first 48 hours. 11 babies required mixed feeding later during hospital stay and 2 were discharged on mixed feeding

93 neonates (29.6%) required treatment for hyperbilirubinemia after 48 hours of postnatal life. All of them required only phototherapy; none required exchange transfusion. The majority (71-76.3%) commenced phototherapy by Postnatal day 3, 15 (16.1%) by Postnatal day 4, 2(2.2%) by postnatal day 5, 3(3.2%) by postnatal day 6, 7(2.2%) by post natal day 7.

Table 2 shows the difference in variables between treatment needed and not needed group. Maternal hypertension was the only variable significantly associated with need of treatment (p= 0.035)

Mean weight loss percentage at 24 hours of life was 5.35±2.52 % and 8.30±3.11 % at 48 hours. Mean transcutaneous bilirubin levels were 7.55±2.15 mg/dL and 11.40±2.22 mg/dL at 24 and 48 hours of life.

The weight loss at 24 hours showed a significant positive correlation with TcB levels (Correlation coefficient 0.377 P value <0.001) whereas weight loss percentage at 48 hours did not show significant correlation with TcB (Correlation coefficient 0.005 P value 0.927). (Figure 1 Figure 2 Table 3)

ROC analysis demonstrated poor predictive accuracy for weight loss at both 24 and 48 hours in identifying neonates requiring treatment for hyperbilirubinemia. (Figure 3 Table 4 Table 5)

DISCUSSION

Neonatal hyperbilirubinemia remains one of the most common morbidities in early neonatal life and is a preventable cause of permanent neurological sequelae. Any factor that help in predicting significant neonatal hyperbilirubinemia is therefore clinically important. This study evaluated if early post natal weight loss could serve as a predictor of significant neonatal hyperbilirubinemia requiring treatment in the first 7 days of life.

The study was conducted in 314 newborns, born at or after 35 weeks of gestation. 35 weeks was opted as cut off as the reference chart used in the institution for prescribing treatment for neonatal hyperbilirubinemia is from the AAP guidelines 2022,[10] that applies to babies above 35 weeks of gestation. Most of the studies conducted in this regard,[9,11,12,13] studied the relation of weight loss and hyperbilirubinemia in term babies born above 37 weeks of gestation. Unlike them we included neonates born at 35 to 37 weeks of gestation, reflecting real world clinical practice where these infants often receive care similar to term neonates under the same protocol. Treatment thresholds also, unlike in these studies, were based on AAP hour specific normograms rather than absolute bilirubin values, enhancing clinical applicability. Also all the babies included in the study were exclusively breastfed for atleast the first 48 hours of life which reflected the natural weight loss pattern.

Regarding the baseline characteristics of the study population, sex ratio 170 females to 144 males is corresponding to that in the general population. 20% of the study population were late preterms and 22.3% were low birth weight. 42% were born through caesarean section, 15% had GDM and 10% had hypertension. The prevalence is significantly high in all as it is a tertiary level reference hospital attending to complicated pregnancies.

The need of treatment for significant hyperbilirubinemia was there in 29.6% of the babies in the study group. This is after exempting babies who had to be started on treatment within the first 48 hours of life, babies who developed jaundice in an incompatibility setting and babies who required NICU admission, IV fluids or formula feeding in first 48 hours of life. So the actual incidence would be even high in the mentioned group in the given setting, which is much higher than the data given by National neonatal perinatal database which is 3.3% in intramural neonates and 22.1%in extramural neonates.[3] Bedi et al reported an incidence of about 5% from a North Indian study,[14] and Manas et al an incidence of 19% in a South Indian study.[15] Higher incidence noted in our study may be due to the increased coexistence of maternal risk factors like gestational diabetes and neonatal risk factors like late preterms, low birth weight in study population. Being an MBFHI certified hospital the exclusive breast feeding rates were also high.

The mean weight loss at 24 hours of life was 5.35±2.52% and at 48 hours of life was 8.30±3.11%. In a systematic review done by Noel-Weiss et al including 11 studies, mean weight loss ranged from 5.7% to 6.6%, with SDs around 2%, with maximum weight loss in second and third days.[16] In study done by Joshi et al on exclusively breastfed babies, nearly 80% babies had a weight loss of 5-10%.[17] The rate and pattern of weight loss was in agreement with the previous studies.

The primary research question in the study was to find out the relation between weight loss and hyperbilirubinemia requiring treatment in the first 7 days of life. From our study, while weight loss at 24 hours showed a significant positive correlation with significant hyperbilirubinemia, weight loss at 48 hours did not show correlation nor did the ROC curve derive weight loss percentages at 24 and 48 hours oflife, that could possibly predict hyperbilirubinemia requiring treatment with sufficient sensitivity and specificity. This was in contrast to various published studies like the Yang et al,[18] study that showed that

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the infants with weight loss percentages more than 10.2% on day1 and more than10.9% by day 2 and Wadhwa et al,[11] study that showed babies with weight loss of >4.4% after 24 hours will have hyperbilirubinemia . As mentioned our study had included late preterm infants (35-37 weeks of gestation). Also we did not include babies who had to resort to mixed feeding in the first 48 hours of life. This might have influenced the weight loss pattern. Also we considered the need of treatment based on values in AAP curve as per risk assessment, rather than an absolute cut off value as in these studies which might have influenced the outcome.

Our findings suggest that early neonatal weight loss alone may not be a dependable predictor of significant hyperbilirubinemia requiring treatment. Also exclusive breastfeeding might be offering protective advantages with respect to hyperbilirubinemia as in enhancing gut motility and preserving gut microbiota thereby helping in bilirubin clearance.[19,20]

The limitations of our study include not incorporating methods for assessing adequacy of breast feeding, not including 72 hour weight loss percentage and limited adjustment for confounding neonatal and maternal factors. Also including newborns who required mixed feeding as separate group might have added to the current knowledge.

CONCLUSION

Percentage weight loss 24 and 48 hours of life neonates born at ≥ 35 weeks of gestation and exclusively breastfed till 48 hours, does not reliably predict significant hyperbilirubinemia requiring treatment in the first 7 days of life. Also normal early weight loss pattern alone with exclusive breast feeding should not be a cause of concern among practicing clinicians to start formula feeding under the fear of hyperbilirubinemia. Comprehensive bilirubin monitoring remains essential irrespective of early postnatal weight loss patterns.

Conflict of Interest: Nil

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