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Determining the Natural Distribution of 24 Hour Bilirubin Levels in Term, Exclusively Breastfed Newborns

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BACKGROUND

Newborn bilirubin levels are routinely measured as hyperbilirubinemia can be neurologically devastating, causing kernicterus in infants. The American Academy of Pediatrics (AAP) recommended clinical evaluation of jaundice in all term infants at 24 hours of life and consideration of a routine serum bilirubin prior to discharge. Bhutani et. al. in 1999 developed a nomogram to categorize full-term infant bilirubin levels based on hours of life and total serum level. These values were stratified into high, high-intermediate, low-intermediate and low risk levels to determine the need of follow up evaluation or treatment. The AAP acknowledges breastfed infants might require closer monitoring, as they can be at higher risk for hyperbilirubinemia. The Bhutani-AAP nomogram was developed using a population of only 49.5% exclusively breast fed infants and 59.2% with any breast feeding.

HYPOTHESIS

Exclusively breastfed infants will have higher bilirubin levels within the first 24 hours of life compared with the current standard reference values.

METHODS

A retrospective electronic chart review of full term infants born at Lehigh Valley Hospital from July 2013 to December 2013 under the service of ABC Pediatrics of Lehigh Valley Physician Group.

Inclusion Criteria:

1. Gestational age at least 35 weeks weighing at least 2500 grams OR gestational age 36 weeks weighing at least > 2000 grams.

Exclusion Criteria:

1. Infants transferred to NICU by 24 hours of life
2. The use of phototherapy in the first 24 hours of life

24 hour bilirubin level, feeding type, and need for phototherapy during newborn admission were recorded for the 1026 eligible infants. These infants were stratified based on feeding types: breastfed, formula 30 mls and formula fed infants. A total of 770 full term infants had outpatient follow up care performed by ABC-LVPG-Pediatrics and were evaluated for the development of any subsequent hyperbilirubinemia.

Each bilirubin was stratified to risk per the classification of the AAP-Bhutani nomogram. All subsequent assessed bilirubin values were then assessed based on the hours of life at which they were obtained, and need for phototherapy. Positive Predictive Value was calculated, as defined by Bhutani et al, as predicting the risk of any subsequent high risk bilirubin.

RESULTS

Table 1: Demographics Based on Feeding Patterns

Feeding Pattern	Number	Percentage	Mean Bilirubin	PPV
Subset BF: exclusively breastfed	567	55.3%	6.11	1.76
Subset FF: exclusively formula fed	195	19.0%	5.99	1.95
Subset F>30: >30mL formula in 1st 24 hrs	180	17.5%	6.33	1.81
Subset F <30: <30mLR formuLRa in 1st 24 hrs	84	8.2%	6.42	1.76

55.3% of infants analyzed were exclusively breast fed, and 81% had any breastfeeding.

Table 2: Exclusively Breastfed infant Risk Stratification and PPV

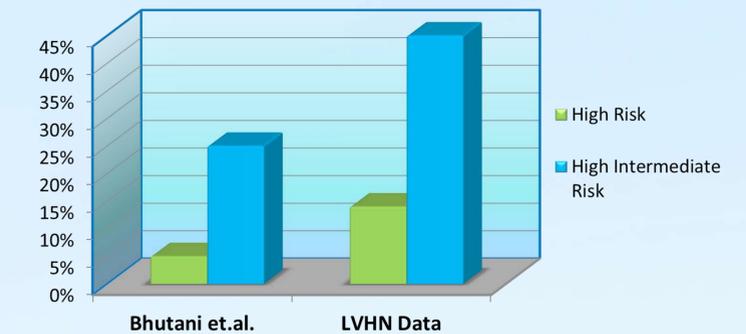
Risk Level at 24 Hours	Number Infants/ Percentage of Population	Subsequent High Risk Bilirubin	PPV
High risk	102/18.0%	37	36.3%
High Intermediate	170/30.0%	4	2.4%
Low Intermediate	172/30.0%	1	0.1%
Low	125/22.5%	0	0.00%

48% of exclusively breastfed infants had high or high intermediate risk stratification at 24 hours of life. The Positive Predictive Value for high risk exclusively breast fed infants, for the development of a subsequent high risk bilirubin phototherapy, of 38.25% is very close to Bhutani et.al of 39.5%. However, the PPV of 2.4% for the high intermediate risk strata is much lower than Bhutani et. al. report of 12.9%.

References:

1. Bhutani, Vinod, Lois Johnson and Emidio M. Silveri. Predictive Ability of a Predischarge Hour-specific serum Bilirubin for subsequent significant hyperbilirubinemia in healthy term and near-term newborns. *Pediatrics*. 1999; 103, 6-13.
2. Management of Hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. *Pediatrics*. 2004; 114, 297-315.

Figure 1. Distribution of breastfed infants compared to those in the Bhutani Nomogram



14% of exclusively breastfed infants were high risk at 24 hours and 45% were high intermediate risk level. This was significantly higher than the 5% high risk and 25% high intermediate risk defined by Bhutani et al. (1999).

CONCLUSIONS

The data supports the hypothesis that breastfed infants have higher bilirubin levels in the first 24 hours of life than predicted by the Bhutani-AAP nomogram. Furthermore, though the PPV of a high risk bilirubin was substantial, only 2.4% of high intermediate risk values developed subsequent significant hyperbilirubinemia. **These results are significant, as more accurate classification of risk would decrease the need and cost of subsequent laboratory evaluation.** Further studies are recommended to create a specific nomogram and risk stratification for breastfed infants. The current Bhutani –AAP system does not accurately reflect or predict the natural history of bilirubin rise in breast fed infants.

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