Transcutaneous Bilirubinometry in Neonates: Evaluation of Minolta Air Shields Jaundicemeter

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Hyperbilirubinemia is one of the most frequently encountered problem in neonates. Hence, serum bilirubin is the most commonly ordered laboratory investigation in the nursery. Sampling of newborns is not only a painful procedure but also occasionally associated with severe sepsis(l). Yamanuchi *et al.* first described a non-invasive device, the jaundicemeter to estimate the serum bilirubin transcutaneously(2). A high linear correlation between the jaundicemeter index and the serum bilirubin has been earlier reported in most ethnic groups(l-8). The present study was designed to determine the correlation between transcutaneous and serum bilirubin estimation among the North Indian neonates of Jammu region.

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Subjects and Methods

The study included 145 neonates admitted to the Children Hospital, Government Medical College, Jammu from March to November, 1992 with clinically appreciable jaundice. Their ages ranged from 2-20 days (only 15 babies were > 10 days). A single set of data was obtained from each patient •and babies < 24 hours of age or those who had undergone exchange transfusion were excluded. The jaundice meter used for transcutaneous bilirubin estimation was **the** Minolta Air shields jaundice-meter. Five readings from the forehead were taken and their mean recorded to the nearest integer. The sample of venous blood for serum bilirubin was drawn within half hour of the transcutaneous estimates and analyzed us-

ing the method of Malloy and Evelyn(9). Data was analyzed in sub-groups: *Group I:* Term neonates (n=60), mean (SD) weight 2935 (208) g, mean (SD) gestation 39.5 (0.9) wks; *Group II:* Preterm (AGA) neonates (n = 12), mean (SD) weight 1800 (304) g, mean (SD) gestation 32.8 (2.2) wks; *Group III:* Small for gestation age (SGA) neonates <n = 40), mean (SD) weight 2280 (268) g, mean (SD) gestation 36.7 (2.9) wks; Group IV: Neonates on phototherapy (babies who were under phototherapy for < 12 hours) (n = 33), mean (SD) weight 2639 (625) g, mean (SD) gestation 38.4 (2.3) wks.

Correlation coefficients were calculated and the most predictive jaundicemeter index for serum bilirubin > 13 mg/dl and > 20 mg/dl were determined.

Results

Table I provides the mean jaundicemeter indices and the 95% confidence intervals for the four groups at serum bilirubin levels of 10, 13 and 20 mg/dl, respectively. *Fig. 1* depicts the correlation of jaundice meter index regressed on serum bilirubin in the four groups. The co-efficient of correlation (r) for the whole study group was 0.71. The correlation coefficients ranged between 0.65-0.83 for the four groups and all were observed to be statistically significant ($p < 0.01$)

TABLE I–*Mean Jaundice Meter Index at 10, 13 and 20 mg/dl S Bilirubin*

Group	Serum bilirubin (mg/dl)	Jaundicemeter index	
		Mean	95 % CI
I	10	17 91	16 66 - 19 16
	13	20 07	18 82 - 21 30
	20	25 11	23 86 - 26 36
II	10	18 94	17 08 - 20 80
	13	20 74	18 88 - 22 60
	20	24 94	23 08 - 26 80
III	10	18 74	17 31 - 20 18
	13	20 57	19 14 - 22 00
	20	24 84	23 40 - 26 27
IV	10	19 10	17 22 - 20 98
	13	20 96	19 08 - 22 84
	20	25 30	23 42 - 27 18

For screening neonates with serum bilirubin > 13 mg/dl, the best predictive jaundicemeter index (action level) was 18. *Table II* provides the predictive values at an index of 18 for a serum bilirubin > 13 mg/dl. For a serum bilirubin of > 20 mg/dl the most predictive jaundicemeter index (action value) was estimated as 23 (the predictive values are not depicted).

Discussion

The present study reveals a good linear correlation of the jaundicemeter index and the serum bilirubin (r = 0.71). The 'r' value in previous studies has varied between 0.94 to 0.70 (1-8). The correlation was maximum in the term babies as compared to the rest of sub groups. It did reduce in infants on photo-therapy (r = 0.65) in this study but remained significant. This observation is similar to that observed by other workers(6.7). Some workers have used opaque skin patches to define the area to be used for jaundicemeter for babies undergoing phototherapy. We did not use this method and feel that as these babies already have almost half of the forehead covered as a part of protecting their eyes, this manouvre may not be required for using the device at forehead.

Although, one fourths of the total jaundiced neonates would be unnecessarily subjected to serum analysis had the jaundice-meter been used to screen these neonates. yet there would be another equal number of babies who would have, been saved from the invasive estimation. In a busy referral hospital laboratory this would mean a reduction of one fourths of

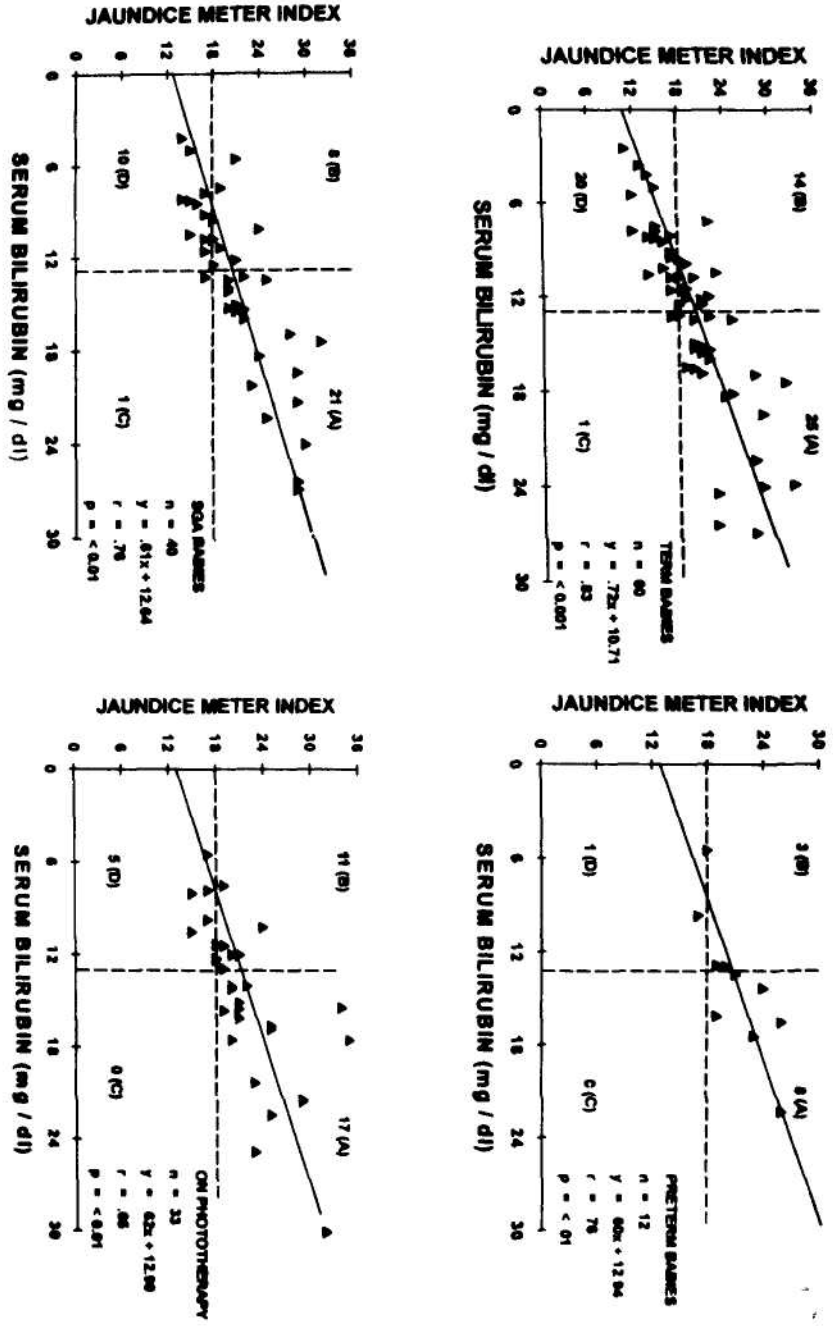

Fig. 1. Correlation Between Jaundice Meter Index and Serum Bilirubin. Upper left-Group I, Upper right-Group II, Lower left- Group III, Lower Right-Group IV.

TABLE II–*Predictive Value of Jaundice Meter Index 18 For Serum Bilirubin ≥ 13 mg/dl*

Group	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)	Accuracy (%)
I	96 2	58 8	64 1	95 2	75 0
II	100 0	25.0	72 7	100 00	81 8
III	95 5	55.0	72 4	90 9	77 50
IV	100 0	31.3	60 7	100 00	66 7
All groups	97 3	50 0	66 34	94 7	73 8

this load. Lastly, half of the total babies where the jaundice-meter predicted the presence of hyperbili-rubinemia correctly did require some modality of treatment.

In this study both the sensitivity and the negative predictive values were high. These results are similar to observations made in earlier studies(4.7). The level of bilirubin of concern varies with the age of neonate. Recently the level of bilirubin indicating use of phototherapy in the term neonates has also been increased(10). Hence, separate action levels will be needed in the same race for less than 24 hours of age (excluded in this study) and the changing indications of phototherapy will require setting of higher action levels.

As is evident, jaundicemeter is simple, easy to use, gives instant results, without any inter observer variation and has high degree of repeatability too. It is concluded that though a jaundicemeter reading cannot accurately predict the serum bilirubin value, it is a useful screening device for neonatal hyperbilirubinemia in the population studied.

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